

WORK ZONE SAFETY INSPECTION TRAINING COURSE

INSTRUCTOR'S GUIDE

Prepared for:
Federal Highway Administration
400 Seventh Street, SW
Washington, DC 20590

Prepared by: Graham-Migletz Enterprises, Inc. P.O. Box 348 Independence, MO 64050

August 1995

WORK ZONE SAFETY INSPECTION TRAINING COURSE

FHWA CONTRACT NUMBER DTFH61-92-C-00052

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Preface

The course material presented was developed under FHWA Contract No. DTFH61-92-C-00052, "Work Zone Safety Inspection Training Course." Information and visual aids were gathered through a review of literature and video tapes and telephone conversations with Federal Highway Administration and state transportation agency personnel and equipment manufacturers. Photographs of work zone situations and traffic control devices were also obtained by project staff through visits to a number of active work zones.

The course materials may be compiled/modified or amended to the extend allowed by the local jurisdiction to reflect State/local standards, specifications, and plans.

CAUTION:

Avoid changes or modifications to the modules herein that, directly or indirectly, affect the Manual of Uniform Traffic Control Devices (MUTCD) Standards. Changes to the course materials representing duly approved changes to the MUTCD will be submitted through approved directives from the Federal Highway Administration.

WORK ZONE SAFETY INSPECTION TRAINING COURSE FHWA CONTRACT NUMBER DTFH61-92-C-00052

Instructor's Guide

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Course Preparation Instructions

The course "Work Zone Safety Inspection" is a modular course that is adapted to the needs of the requesting agency. Several preparatory steps are necessary to determine agency procedures and modules to be presented.

These preparatory steps include preparing an introductory letter to obtain needed information, preparing an agency-specific agenda, and tailoring the two workshops to the procedures and modules desired by the agency.

Following is an approximate schedule for preparing for the workshop. It is imperative that the initial request letter be sent 6 weeks before the workshop and that materials be received at least 2 weeks before the presentation.

Sample Preparation Schedule

6 Weeks Prior to Course Presentation

1. Send initial request letter.

3 Weeks Prior to Course Presentation

- 1. Make sure that agency has replied and that materials are available.
- 2. Get address where notebooks can be sent.

1 Week Prior to Course Presentation

- 1. Prepare specific agenda.
- 2. Sort course materials to cover chosen modules.
- 3. Review materials and determine specific information to include in contract documents module and workshop Parts 1 and 2 (see the modules elsewhere in this Guide for more information).
- 4. Note agency-specific information to include in chosen modules such as: type of barrier connector and flagging equipment, in addition to national standards, required sheeting, etc.
- 5. Make copies of agenda, handouts, and workshop instructions.

1 Day Prior to Course Presentation

- 1. Locate training site and check seating, projectors, and VCRs.
- 2. Verify notebook availability.

Initial Request Letter

This letter is sent to the local jurisdiction's contact person upon their decision to sponsor the course presentation. A copy of a generic letter follows on the next page. Items that need to be changed to make the letter specific to a certain instructor and sponsoring agency are shown in **bold**. The letter will request all the materials necessary from the local jurisdiction to present the course and customize it sufficiently to make it applicable in a wide variety of locales.

{INSTRUCTOR AGENCY} {LETTERHEAD}

{DATE}

Mr./Ms. {HIGHWAY ENGINEER} {AGENCY} {STREET ADDRESS} {CITY, STATE, ZIP}

Subject:

Federal Highway Administration

Work Zone Safety Inspection Training Course

Dear Mr./Ms. {ENGINEER}:

Thank you for requesting the Work Zone Safety Inspection training course. This one-day training course covers critical elements of work zone safety devices and hardware from the viewpoint of inspection. Major components of safety hardware utilized in highway work zones are discussed and the principal areas of each device requiring inspection are treated. The FHWA Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD) is used to present device standards. The American Traffic Safety Services Association (ATSSA) Quality Standards for Work Zone Traffic Control Devices will be used to evaluate the condition of devices. Plans, specifications, contract documents, and inspection guidelines from the {AGENCY NAME} will be used as examples of the contract documents that address the layouts, operation, maintenance, and repair of the devices. Checklists for inspection of various work zone devices are included in the course notebook.

Upon completion of the course, highway agency inspectors, project engineers, and technicians should be able to:

- 1. Understand the important features and functional requirements of typical traffic control devices and safety appurtenances used in work zones.
- 2. **Identify**appropriate documentation, such as the contract, traffic control plan (TCP), specifications, special provisions, standard drawings, and change orders that address the layouts, operation, maintenance, and repair of the devices.
- 3. **Inspect** common traffic control devices and safety features, and identify discrepancies (disagreements and differences) and deficiencies (not up to normal standards).
- 4. **Establish** records related to inspections and actions taken. Resolve and correct discrepancies. Make recommendations and report deficiencies.

The work zone safety inspection course comprises both core and optional modules. Optional modules are selected by you to address areas of interest to your Agency. A typical one-day course schedule is attached.

In order to incorporate your specifications into the course, we will need to obtain some information and an example traffic control plan from you. A summary of the needed information is given on the enclosed request form.

This form also asks for the modules your Agency would like presented for a one-day course. Up to **2 hours** of additional modules can be presented in a one-day course. Please indicate the modules you would like us to present.

The course is designed for the highway work zone safety inspector/technician level and will assume that the inspector has some field experience. A few work zone traffic control plan designers and resident/project engineers will provide a variety of viewpoints to help inspire discussion. Please ask each participant to bring a copy of your agency's specifications. We limit the class size to 40 and have also included specifications for a classroom of 40 participants.

Please designate a participant or send a person who is familiar with your agency's policies and procedures. Input from this person will aid us in making the presentation specific to your agency.

If there are questions, please feel free to contact me.

Sincerely,

{INSTRUCTOR NAME} {INSTRUCTOR TITLE}

Enclosures

Work Zone Safety Inspection Training Course One-Day Schedule

Module	Time
Introduction	8:00 - 8:30
Description of Course	
Objectives of Course	
Scope of Course	
Attributes of a Good Inspector	
Inspection Basics	8:30 - 9:45
Contract Documents	
Inspection Procedures	
First Inspection Workshop	
Break	9:45 - 10:00
Nighttime Traffic Control	10:00 - 10:15
Retroreflective Sheeting	10:15 - 10:30
Optional Modules to be Selected by the Agency	10:30 - 12:00
Lunch	12:00 - 1:00
Optional Modules to be Selected by the Agency (concl.)	1:00 - 1:30
Second Inspection Workshop	1:30 - 3:00
Break	3:00 - 3:15
Summary	3:15 - 3:40
Course Evaluation	3:40 - 4:00

Work Zone Safety Inspection Training Course Request Form

Agency: Arizona DOT	Contact:	
Telephone Number:	Fax Number:	
Optional Modules Requested: Check-o of optional modules will be presented.	ff the selected modules and	d add the times. Up to two hours
		Estimated Time (minutes)
Flagger/Devices		15
Signs/Supports		
Signs		10
Sign Supports		10
Portable Changeable Message Signs		15
Arrow Panels		12
Channelizing Devices		15
Cones		
Tubular Markers		
Vertical Panels		
Drums		
Barricades (Types I, II, and III)		
Portable Barrier		
Temporary Raised Islands		
Marking/Delineators		
Pavement Markings		5
Interim Markings		10
Raised Pavement Markings		10
Delineators		5
Lighting Devices		
Warning Lights		10
Floodlights		5

Construction Zone Impact Attenuators		
G.R.E.A.T. CZ (Guard Rail Energy Absorbing Terminal,	20	
Construction Zone) Sand-Filled Barrels	20	
ADIEM (Advanced Dynamic Impact Extension Module)	15 5	
ADIEM (Advanced Dynamic Impact Extension Module)	.	
Barrier		
Portable Concrete Barrier	15	
Movable Concrete Barrier	10	- ",
Plastic Water-Filled Barrier	5	
Truck-Mounted Attenuator	10	· · · · · · · · · · · · · · · · · · ·
Post Test	30	
Total amount of time for selected modules:		
Checklist of Information Needed:		
Please provide one copy of each of the following for the instructor:	and of √s	
Standard Specifications (for Road and Bridge Construction)		
Contract with Special Provisions		· :
Example Traffic Control Plan		
Standard drawings of work zone traffic control devices and safety hardware		
Specifications for portable concrete barrier and connectors		-
State work zone safety inspection procedures, guidelines, and fo	rms	
Example of Certificate of Compliance		
Example of Change Order		-
Example of Documentation Record		

	Classroom for 40 participants	X .
	Slide projector	- , , , , , , , , , , , , , , , , , , ,
	Screen	
	Overhead projector	
	Easel with blank sheets and marking pens	
,	Pencils and notepads	
	Coffee, soft drinks, etc. or the facilities where	- 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1

Please return this completed form and requested information to:

[INSTRUCTOR]
Work Zone Safety Inspection Training Course
[ADDRESS 1]
[ADDRESS 2]

Facility Checklist

Format of Instructor's Guide

One other thing prospective instructors will need to do to prepare for this course is become very familiar with the format of the Participant's Notebook and Instructor's Guide. The layout of the Notebook is fairly simple. The first modules are the core of the course and are to be taught at every presentation. This includes all modules up to Module IV, Flagging.

After this, the modules that the agency selects are included, up to Module XIII, Truck-Mounted Attenuators. A short description of the second inspection workshop is then included, and then the rear of the notebook is supplemental information. The Notebook employs a very simple numbering scheme designed to facilitate the modularity of the course. Each module starts with a new page 1 with a prefix indicating the module number. In other words, Module I.A. starts with page number 1A-1, module VIII.B. numbers page 8B-1, 8B-2, 8B-3, etc.

The format of this Instructor's Guide is somewhat more complex. First, there are additional sections, such as this one, with instructor-only information. Each module begins with an instruction summary, which gives some clues about optional methods of presentation, and also lesson plans for that module. Following these instruction summaries are pages that are basically a copy of the Participant's Notebook modules. However, these pages contain additional information in a second column (not present in the Participant's Notebook) that relate the visual aids to be used to the information in the Notebook. This information consists basically of a visual aid code number and the title of the visual aid (if it is a word-oriented visual aid) or a description of the visual aid (if it is a photographic visual aid).

The page numbering scheme used to organize all of the information contained in this Instructor's Guide also merits some explanation. On the pages of this Guide that contain the copies of the Participant's Notebook information, along with visual aid information for the instructor, there is a page number identical to the number in the Participant's Notebook along the bottom of the page. However, since this Guide contains many more pages and supplemental information, a second page numbering scheme has also been included, consisting of a number in the format of IG-x at the top right of every page in this Guide. This page number is for the Instructor's Guide only, and the pages number consecutively from front to back of the Guide.

Therefore, it is possible to use the Table of Contents of the Instructor's Guide to locate any needed information easily, but it is still easy to direct student's attention to points in the Notebook using a page numbering system that is identical to the one in the Notebook.

A final note about the instruction summaries in this Instructor's Guide is that the lesson plans, in general, are basically descriptions of what points a potential instructor might make to the class during instruction. However, there are some instructions for the instructor alone that appear in **bold** print in the instruction summaries. This information in bold generally consists of instructions on actions to take while teaching a module, such as switching the presentation method to slides from

overheads or pointing out information in a corollary reference, such as the ATSSA Quality Standards or the MUTCD Part VI.

Training Facility Arrangements

The environment of the presentation is an area in which a small investment of preparation time pays large dividends. Part of this preparation will be done far in advance of your presentation or class.

In spite of the best advance planning, many issues are beyond your control in some of the classrooms. However, any advance planning can improve the learning environment and enhance the quality of the training.

Here are some issues you may have to deal with:

Temperature

Check the temperature FIRST because it takes a long time for adjustment to take effect. Remember, an empty meeting room should be uncomfortably cool, as many bodies will raise the room temperature quickly. Ideal room temperature should allow people to be comfortable in the style of clothing appropriate to the occasion and season.

Sound

It is essential that your voice and the sound level be appropriate for all members of your audience. If there is sound amplification equipment available, use it. Remember that bodies soak up sound. Also, there are more hearing impaired people than you may imagine.

Light

Check the room before your presentation and assess whether the light is appropriate for the speaker and for all visual aids and props. Check the lighting levels for the audience as well to determine if there is enough light for notes and reading. It is essential that proper lighting be used so videos can be seen by all participants.

Seating

Proper seating is a major factor in making your class a success. A proper learning environment cannot be maintained if seating is uncomfortable or does not meet the needs of the classroom activities.

Remember people tend to sit in the back of the room so only ask for as much seating as you need for the course to fill all available spots. This also allows for the tables to be spread out to assist in group work.

Problem Rooms

The following are hints on what to do with problem rooms:

- If the room is so large it feels like a cavern, then:
 - Set up in an end or corner, and
 - Mark the boundary with some room divider or ribbon.
- If the room has pillars, then:
 - Try to arrange seats so all participants can see:
 - Each other,
 - Audio-visual aids, and
 - You.
- If the room is filled with distractions such as elaborate audio/visual equipment, couches, large paintings, stuffed owls, etc., then:
 - Remove what you can and cope with the rest.

Training Facility Requirements

Since the goal of this course is knowledge acquisition and awareness, it is best to use classroom style seating. This section briefly discusses the advantages and disadvantages of the type of facility recommended, then lists the room and audio/visual requirements of the recommended facility. It is recommended that you forward this list of requirements to ensure the proper arrangements are made before you arrive for the training.

Advantages and Disadvantages of the Recommended Facility

The following are advantages of a facility of the type recommended:

- This is a universal setting and can be arranged in nearly every facility.
- This is a familiar, easy setup that most facilities can accommodate.
- The participants have a comfortable writing surface and refreshments are easily accommodated.

The following are disadvantages of a facility of the type recommended:

• When working in groups it is necessary to work with adjacent persons unless there is room to turn around and face people at a table behind you.

Room/Furniture Requirements

- Training room, with 10- or 12-foot ceilings, large enough for minimum 4-foot center aisle, foot side aisles, video monitor, demonstration table, overhead projector and screen, and enough tables and chairs for all participants.
- Tables should be at least 30 inches wide and 6- to 8-feet long.
- There should be 3 to 4 chairs per table.
- Tables should be spaced at least 36 inches apart to allow group activity around the table.

Audio/Visual Equipment Requirements

- One 1/2-inch VHS VCR and one 25-inch color monitor.
- One demonstration table, minimum 9 feet long and 30 inches wide.
- Podium or additional table with table top podium.
- Room should have adequate temperature control and ventilation.
- Room should have convenient light controls.
- One overhead transparency projector on cart or small table.
- One slide projector on cart or small table.
- One projection screen, minimum 6 foot square.

Example Specific Agenda

The specific agenda used for the second pilot presentation is used as an example of how to create a specific agenda from agency module selections. The agenda created is shown on the next page.

AGENDA

Work Zone Safety Inspection Training Course Second Pilot Presentation-Sterling, VA March 23, 1995

Module	Time
Introduction	8:00 - 8:30
Description of Course	
Objectives of Course	**
Scope of Course	
Attributes of a Good Inspector	
Inspection Basics	8:30 - 9:45
Contract Documents	
Inspection Procedures	
First Inspection Workshop	
Break	9:45 - 10:00
Nighttime Traffic Control	10:00 - 10:15
Retroreflective Sheeting	10:15 - 10:30
Flagging Inspection	10:30 - 10:45
Portable Changeable Message Signs	10:45 - 11:00
Arrow Panels	11:00 - 11:15
Channelizing Devices	11:15 - 11:30
Markings	11:30 - 12:00
Lunch	12:00 - 1:00
Warning Lights	1:00 - 1:10
Sand-Filled Barrels	1:10 - 1:25
Portable Concrete Barrier	1:25 - 1:40
Second Inspection Workshop	1:40 - 3:00
Break	3:00 - 3:15
Summary	3:15 - 3:40
Course Evaluation	3:40 - 4:00

Module I.A. Description of Course

INSTRUCTION SUMMARY

Duration:

5 minutes

Objective:

To familiarize students with the basic layout of the course, and what to expect

throughout the instruction.

Content:

Safety Aspects, MUTCD, Course Sections

Equipment:

Overhead Projector

Aids:

2 Overhead Transparencies

PRESENTATION OPTIONS

If not mentioned as part of the initial course welcome, you may wish to introduce instructors, or talk about the need for work zone training. You may also wish to go over the agenda at this point, if this was not done in the course welcome.

LESSON PLAN

OH1A-1 - DESCRIPTION OF COURSE

- Course addresses inspecting the safety aspects of work zones.
- The intended audience is work zone inspectors.
- Bulk of course concentrates on the devices that need inspection and what to look for when inspecting those devices.
- The FHWA MUTCD Part VI is used as the starting point for device standards in this course; individual agencies may vary somewhat; some may have their own MUTCD, others may have supplements that exceed the requirements of the MUTCD.
- As an instructor you may want to ask the class, "What are the standards in your jurisdiction? Is the FHWA MUTCD followed verbatim, or are there changes or additions?"
- All reasonable effort has been expended to acquire plans, specifications, and other contract documents from the local jurisdiction to use as examples.
- Two modules will be conducted in order for students to apply inspection techniques taught for specific devices in class.

OH1A-2 - COURSE SECTIONS

- The first part of the course presents the basic information about work zone inspections.
- After this, the first inspection workshop will be conducted.
- Your jurisdiction has selected from among several device modules; the agenda should show which modules will actually be presented.
- After the device modules, the second inspection workshop will be conducted.
- Finally, the summary and post test (if requested) will be given.
- The final portion of the notebook has sources of additional information and a glossary of work zone terms.

VISUAL AIDS

1 - DESCRIPTION OF COURSE

- Addresses Work Zone Safety Inspection.
- Course Intended for Construction Zone Inspectors.
- Discuss Components Requiring Inspection.
- FHWA MUTCD Part VI Presents Device Standards.
- Plans, Specifications, and Other Contract Documents are Used as Examples.
- Workshops Enable Inspectors to Apply Inspection Techniques.

2 - COURSE SECTIONS

- Introduction and Inspection Basics
- First Inspection Workshop
- Device Modules
- Second Inspection Workshop
- Supplemental Information

Module I.A. Description of Course

Participant's Notebook Text

This course covers the critical elements of inspecting safety aspects of construction zones. Major components of safety hardware utilized in construction zones are discussed and the principal areas of each device requiring inspection are treated. The MUTCD is used to present device standards. Plans, specifications, and other contract documents from your State are used as examples of the contract documents that address the layouts, operation, maintenance, and repair of the devices.

Visual Aids

OV1A-1 Description of Course

The course, and this notebook, can be divided into three main parts:

OV1A-2 Course Sections

PART 1 - INTRODUCTION AND INSPECTION BASICS: This part introduces the course, its objectives, and gives basic information on inspection documents and procedures. Nighttime traffic control, and its overall importance to work zone safety, is discussed, along with procedures for inspecting retroreflective sheeting.

PART 2 - DEVICE MODULES: This part consists of 25 separate modules, each covering one specific, or category of, traffic control devices. Usually only a subset of these device modules will be presented, depending on the length of the training course and the modules selected. These modules are designed to give specific criteria for identifying deficiencies with work zone safety hardware and traffic control devices. To this end, each of these modules has an inspection checklist at the end. The module itself is adapted from the checklist in order to give the most specific information on each device. To the extent possible, the material focuses on determining the quality of devices and identifying common deficiencies that arise for each device.

PART 3 - SUPPLEMENTAL INFORMATION: The appendix presents references with sources of more information in a bibliography-style format. The information is grouped according to specific device type, allowing for easily directed searches for additional material. The glossary presents definitions of commonly used work zone terms.

In addition, the in-class instruction will include two inspection workshops. In the first, you will be given a set of plans to review. You will be asked to determine how you would go about inspecting the work zone depicted in the plans. In the second workshop, you will be given photographs that represent the conditions found at that work site. You will be asked questions about the inspection of the devices pictured.

Module I.B. Objectives of Course

INSTRUCTION SUMMARY

Duration:

5 minutes

Objective:

To make course participants familiar with the overall objectives of the course.

Content:

Understand Traffic Control, Identify Documentation, Inspect TCDs, Assure Quality,

Establish Records

Equipment:

Overhead Projector

Aids:

1 Overhead Transparency

PRESENTATION OPTIONS

If not pointed out earlier in the presentation, this module is an excellent opportunity to stress the emphasis of the course on quality assurance of traffic control devices. One of the objectives covers this point, and it may be useful to introduce, or mention again, the ATSSA booklet that is used as a supplement to the Participant's Notebook.

LESSON PLAN

OV1B-1 - OBJECTIVES OF COURSE

- The student should be able to understand traffic control devices and safety appurtenances, and know their purpose in the work zone.
- The student should be familiar with the documents related to work zone traffic control and safety inspection.
- Students are expected to learn specific inspection techniques for the devices covered.
- Students should learn the difference between discrepancies and deficiencies (discrepancies are differences between plans and field conditions, deficiencies are work zone items that do not meet standards), particularly deficiencies in quality of devices.
- Students must learn the importance of the safety inspection program and to understand and be able to create the documents that substantiate the existence of such a program within a highway agency.

VISUAL AIDS

1 - OBJECTIVES OF COURSE

- Understand important features of TCDs used in work zones.
- Identify documents that address layouts, operation, maintenance, and repair of the devices.

- Inspect TCDs and safety features and identify discrepancies and deficiencies.
- Assure TCDs and safety features meet minimum quality standards.
- Establish records of inspections and actions taken; resolve and correct discrepancies; report deficiencies.

Module I.B. Objectives of Course

Participant's Notebook Text

Upon completion of the course, highway agency inspectors, project engineers, and technicians should be able to:

Visual Aids
OV1B-1
Objectives of Course

- 1. **Understand**the important features and functional requirements of typical traffic control devices and safety appurtenances used in work zones.
- 2. **Identify**appropriate documentation, such as the contract, traffic control plan (TCP), specifications, special provisions, standard drawings, and change orders that address the layouts, operation, maintenance, and repair of the devices.
- 3. Inspect common traffic control devices and safety features and identify discrepancies (disagreements and differences) and deficiencies (not up to normal standards).
- 4. **Ensure** that work zone safety appurtenances and traffic control devices meet minimum quality standards.
- 5. Establish records related to inspections and actions taken. Resolve and correct discrepancies. Make recommendations and report deficiencies.

Module I.C. Scope of Course

INSTRUCTION SUMMARY

Duration:

10 minutes

Objective:

To familiarize students with the type of material that will be presented in the course.

Content:

Inspection Basics, Device Modules, Inspection Checklists

Equipment:

Overhead Projector, Slide Projector

Aids:

1 Overhead Transparency of the course agenda, 34 slides

PRESENTATION OPTIONS

An overhead of the course agenda is useful here to show which device modules have been selected by the local jurisdiction for presentation. After discussing which modules will be presented is a good time to discuss the format of the Participant's Notebook modules and how the checklists form the basis for the notebook material, the class presentation, and that they will be the most useful information for the students after the class is concluded.

LESSON PLAN

Course Agenda

- Briefly discuss the agenda, the format of the course, and the notebook.
- Inspection checklists form the basis for the notebook modules and the in-class instruction.
- The notebook has three sections: Inspection Basics, Device Modules (with checklists for each device), and the Supplemental Information (references and glossary).

At this point, the presentation method switches to slides. Explain that you will be showing several slides that illustrate some of the points and devices that we will be discussing for the remainder of the course.

SL1C-1 - MUTCD, Part VI, and "Roadside Design Guide"

- These are the references that will be used in the course.
- The MUTCD presents the national standards on traffic control devices for streets and highways.

- Shown in the middle is the revised Part VI of the MUTCD. It deals specifically with work zones.
- The "Roadside Design Guide" presents a synthesis of current guidelines and operating practices related to roadside safety. Chapter 9 deals with safety appurtenances for work zones. It is presently being revised and updated.

SL1C-2 - FP-92 and "Missouri Standard Specifications for Highway Construction"

- These are examples of standard specifications. We will be using your agency's specifications in the course.

SL1C-3 - ATSSA Quality Standards and "Missouri Quality Standards for Work Zone Traffic Controls"

- These references are used to evaluate the quality of devices used in work zones. Device quality is evaluated prior to the devices being installed in the work zone, during the initial set up, and periodically during the life of the project.
- The ATSSA Guide is used as a supplement to this course, and there should be a copy of it in your notebook.
- Sometimes, individual States produce their own versions of the quality standards, as has been done in our home state of Missouri.
- Does your local jurisdiction have such a document describing quality standards?

SL1C-4 - Checklist Slide

SL1C-5 - Inspector measuring a barricade stripe

- We'll discuss what it takes to be a good inspector.

SL1C-6 - Night view of work zone showing channelizing devices, signs, and delineators

- We'll show a video that discusses the importance of using good devices that improve nighttime work zone visibility.

SL1C-7 - DO NOT ENTER signs - daytime

- Just because a device is visible during the day...

SL1C-8 -DO NOT ENTER signs - nighttime

- ... doesn't mean that the device will be visible at night.

SL1C-9 - Highway worker washing a LEFT LANE CLOSED AHEAD sign

- The video also addresses maintenance of work zone traffic controls.

SL1C-10 - Inspector reviewing a TCP

- In the module on Inspection Basics, we will describe some of the contract documents that you'll be working with and how they relate to one another.
- Inspection procedures will be described.
- The module will end with a workshop that lets you use a traffic control plan to identify what will be inspected and how to do it.

SL1C-11 - Flagger leaning against a car with STOP sign nearby

- The first module deals with inspection of flagging. We'll show a video that covers the important issues of flagging.
- Is this an acceptable flagging procedure?

SL1C-12 - Flagger with a SLOW paddle

- Of course, this is the SLOW side of the paddle.

SL1C-13 - Flagger with Flashing STOP/SLOW Paddle

- New flagging paddles with high-intensity flashing lights are now being used in many States.
- If your agency is using these, make sure that the lights are working and are visible from a great distance.

SL1C-14 - REVERSE CURVE sign with 40 mph advisory speed plate

- The next module addresses signs, including the supports and the retroreflective sheeting.

SL1C-15 - LEFT LANE CLOSED AHEAD sign with scratches

- Can someone tell me if this sign is acceptable, marginal, or unacceptable?
- Introduce the aspect of "Quality" of a device. See the ATSSA Quality Standards reference.

- Refer to the sample signs as examples of acceptable, marginal, and unacceptable.

SL1C-16 - Portable changeable message sign - ONE LANE ROAD 2 MI AHEAD

Portable changeable message signs warn and instruct drivers.

SL1C-17 - Portable changeable message sign - SPEED LIMIT 45

- The module will address the placement, usage, and inspection of portable changeable message signs.
- Check all of the messages.
- Is this an acceptable message?

SL1C-18 - Arrow panel with right arrow

- We'll show a video on inspecting arrow panels.
- Arrow panels are one of the most effective devices used in work zones.

SL1C-19 - Arrow panel with a light out in the arrow head

- An arrow panel with lights out can present a misleading and dangerous message to drivers.
- Is this an acceptable arrow display?

SL1C-20 - Sequential Chevron with a light out

- Is this an acceptable arrow display?

SL1C-21 - Cones

- The module on channelizing devices addresses some of the common devices used in work zones.
- The ATSSA Quality Standards is used as the reference to judge the quality of devices.
- Included in the modules are cones,...

SL1C-22 - Tubular Markers

- Tubular Markers,...

SL1C-23 - Vertical Panels

Vertical Panels,...

SL1C-24 - Drums

- Drums....

SL1C-25 - Barricades

- Barricades,...

SL1C-26 - Temporary Raised Island

and, Temporary Raised Islands.

SL1C-27 - Conflicting pavement markings

- Pavement markings and delineators are important for keeping drivers on the correct path through the work zone. Missing or confusing markings can lead to problems.

SL1C-28 - Warning light

- Lighting devices help identify potential hazards, guide motorists, and make it possible for work to be done at night.

SL1C-29 - "Close-up view of the GREATcz"

- Impact attenuators protect motorists from injuries caused by accidents at critical areas in work zones.
- The GREAT is one common type.

SL1C-30 - "View from rear of sand barrel array"

- Sand barrels are another type that protect motorists from the exposed end of this barrier.
- We will also address the ADIEM which is made of light-weight, crushable concrete.

SL1C-31 - View along a run of portable concrete barrier

Portable concrete barrier protects both workers and motorists. To be effective, they must be properly installed and maintained.

SL1C-32 - View along the movable barrier

- A newer type of barrier is the movable concrete barrier, which is made of a series of onemeter (one-yard) sections that can be picked up and moved over a distance of up to one lane width.
- It can also lessen the damage done by a vehicle as shown by the small pocket that resulted from an impact.

SL1C-33 - View of a truck with an arrow panel and TMA

Truck-mounted attenuators have been shown to save the lives of motorists and workers and are a valuable safety device.

SL1C-34 - Problems

- Poor sight distance.
- No warning signs.
- After all of these modules have been covered, there will be a second inspection workshop. Here you will get a chance to inspect and evaluate work zone safety hardware and traffic control devices.
- Then we will discuss, summarize, and evaluate the course.

At this point turn off the slide projector and bring up the lights.

- That was a brief overview of what we'll be covering in the course.
- Are there any questions before we begin with the course material?

VISUAL AIDS

- SL1C-1 MUTCD, Part VI, and "Roadside Design Guide"
- SL1C-2 FP-92 and "Missouri Standard Specifications for Highway Construction"
- SL1C-3 ATSSA Quality Standards and Missouri Quality Standards for Work Zone Traffic Controls
- SL1C-4 Checklist Slide
- SL1C-5 Inspector measuring a barricade stripe
- SL1C-6 Night view of work zone showing channelizing devices, signs, and delineators
- SL1C-7 Do Not Enter signs daytime
- SL1C-8 Do Not Enter signs nighttime
- SL1C-9 Highway worker washing a LEFT LANE CLOSED AHEAD sign
- SL1C-10 Inspector reviewing a TCP
- SL1C-11 Flagger leaning against a car and STOP sign leaning a support
- SL1C-12 Flagger with a SLOW paddle

- SL1C-13 Flagger with Flashing STOP/SLOW Paddle
- SL1C-14 Reverse Curve sign with 40 mph advisory speed plate
- SL1C-15 LEFT LANE CLOSED AHEAD sign with a lot a scratches
- SL1C-16 Portable changeable message sign ONE LANE ROAD 2 MI AHEAD
- SL1C-17 Portable changeable message sign SPELD LIMIT 45
- SL1C-18 Arrow panel with right arrow
- SL1C-19 Arrow panel with a light out in the arrow head
- SL1C-20 Sequential Chevron with a light out
- SL1C-21 Cones
- SL1C-22 Tubular Markers
- SL1C-23 Vertical Panels
- SL1C-24 Drums
- SL1C-25 Barricades
- SL1C-26 Temporary Raised Island
- SL1C-27 Conflicting pavement markings
- SL1C-28 Warning light
- SL1C-29 Close-up view of the GREATcz
- SL1C-30 View from rear of sand barrel array
- SL1C-31 View along a run of portable concrete barrier
- SL1C-32 View along the movable barrier
- SL1C-33 View of a truck with an arrow panel and TMA
- SL1C-34 Problems

Module I.C. Scope of Course

Participant's Notebook Text

The major elements of work zone safety inspection as presented in this course comprise the following subject areas:

Visual Aids Slide PresentationRefer to Lesson Plan

PART 1 - INTRODUCTION AND INSPECTION BASICS

- I. Introduction
- II. Inspection Basics
 - Contract Documents
 - Inspection Procedures
 - Inspection Workshop
- III. Elements of Nighttime Traffic Control
 - Nighttime Traffic Control
 - Reflective Sheeting

PART 2 - DEVICE MODULES

- IV. Flagger/Flagging Devices
- V. Signs/Supports
 - Signs
 - Sign Supports
- VI. Portable Changeable Message Signs
- VII. Arrow Panels
- VIII. Channelizing Devices
 - Cones
 - Tubular Markers
 - Vertical Panels
 - Drums
 - Type I, II, & III Barricades
 - Portable Barrier
 - Temporary Raised Islands

IX. Pavement Markings/Delineators

- Pavement Markings
- Interim Markings
- Raised Pavement Markings
- Delineators

X. Lighting Devices

- Warning Lights
- Floodlights

XI. Construction Zone Impact Attenuators

- G.R.E.A.T. CZ
- Sand-Filled Barrels
- ADIEM

XII. Barriers

- Portable Concrete Barrier
- Movable Concrete Barrier
- Plastic Water-Filled Barrier

XIII. Truck-Mounted Attenuators

The course will also include two inspection workshops and a summary of the material presented.

Usually, only a selected portion of the Part II modules will be discussed in detail in the classroom. The concluding section of each module is an inspection checklist for that module. The checklists are intended as a beginning point for the work zone hardware inspection process. These checklists help the beginning inspector by identifying items that must be checked. They are equally valuable to the experienced inspector: 1) to ensure that a critical item is not overlooked in the inspection process, 2) to document that an inspection has taken place, and 3) to document the results of that inspection. These checklists are intended as a starting point. They should be used and modified with field experience to best fit the needs of the particular project or situation. Also, they may need to be modified to be in agreement with highway agency requirements.

Module I.D. Attributes of a Good Inspector

INSTRUCTION SUMMARY

Duration:

10-15 minutes

Objective:

To make participants aware of what is required to be a good inspector

Content:

Introduction, Inspector Authority, Inspection Skills, Responsibilities of an Inspector

Equipment:

Overhead Projector

Aids:

4 Overheads or 1 Video

PRESENTATION OPTIONS

The Participant's Notebook includes information from the Texas DOT's "Inspector's Training Manual." Some agencies may publish specific duties of inspectors that can be substituted. If nothing specific to the agency is available, question participants about how their agency is different.

Alternately, the International Road Federation videotape "Installation, Inspection, and Maintenance of Work Site Traffic Control Devices" can be shown instead of the overheads. Only the last 14 minutes of the 24-minute video needs to be shown.

LESSON PLAN

Introduction

- Inspector must "make calls" concerning contractors' actions.
- Lots of devices and procedures to review.
- Course covers a process for making inspections.

OV1D-1 "Inspector Attributes"

- Must be consistent in calls made.
- Decisions must be fair.
- To cover all aspects, inspector must be methodical.

OV1D-2 "Inspector Authority"

- Ensure public and worker safety.
- Inspect, advise contractor, reject if unacceptable.
- Can delay project if necessary.

OV1D-3 "Inspector Skills"

- Compare field with plans.
- Check implementation.
- Spot differences.
- Documentation.
- Communication.

OV1D-4 "Inspector Responsibilities"

- Safety!
- Know contract documents.
- Perform inspections.
- Discrepancies and Deficiencies.

VISUAL AIDS

1 - INSPECTOR ATTRIBUTES

- Consistent.
- Fair.
- Methodical.

2 - INSPECTOR AUTHORITY

- Inspect All Aspects of Work Zone Safety Devices.
- Ensure Public and Worker Safety.
- Advise Contractor of Unacceptable Practices.
- Reject Faulty Materials, Methods, and Devices.
- Delay Project if Necessary.

3 - INSPECTION SKILLS

- Compare Field Conditions to Plans.
- Check TCP Implementation.
- Spot Problems.
- Document Compliance.

• Communicate With Contractor and Project Manager.

4 - INSPECTOR RESPONSIBILITIES

- Provide for Safety.
- Know Specifications, Special Provisions, and Plans.
- Perform Inspections.
- Point Out Discrepancies and Deficiencies.
- Document Inspections and Corrections.

Optional Videotape, IRF Jobsite Safety Series

"Installation, Inspection, and Maintenance of Work Site Traffic Control Devices," 24 minutes.

Module I.D. Attributes of a Good Inspector

Participant's Notebook Text INTRODUCTION

Visual Aids

As an Inspector, you are asked to "make calls" like a basketball referee. A referee has to "call" fouls and other violations, and you must "call out" discrepancies or deficiencies in the construction zone safety hardware.

OV1D-1 Inspector Attributes

Since there are many different devices and procedures used in a typical construction zone, a good inspector must be methodical in examining all devices to be used in a particular work zone. You must also be consistent in the calls that you make.

This course describes an overall process for inspections that includes review of contract documents, yard review of devices prior to placement, drive-thru inspections of the general placement and condition of traffic control devices, and safety hardware and specific "modules" of detailed walk-up inspections to make on each device in the work zone. Checklists are discussed that will help you make sure you have inspected all areas for a specific construction zone.

The following sections from Texas DOT's "Inspector's Training Manual" cover the authority, skills, and responsibilities of an inspector.

INSPECTOR AUTHORITY

OV1D-2 Inspector Authority

General Areas of Authority

The Department gives Inspectors general authority to:

- Make judgments,
- Give instruction,
- Protect the Department's interests, and
- Ensure that the Contractor's TCP implementation complies with the plans and specifications.

Specific Areas of Authority

The specific areas of your authority include:

- Inspecting all aspects of traffic control on the project;
- Protecting public and employee safety according to State and Federal regulations;

- Advising the Contractor's representatives when any aspect of the TCP setup is unacceptable;
- Rejecting faulty or unauthorized materials, methods, or devices; and
- Delaying work when you and the Contractor disagree until you obtain the Contractor's compliance or Engineer's decision.

Restrictions

Your authority as an Inspector has restrictions. You cannot:

- Initiate or approve changes in any part of the plans or specifications,
- Act as foreman,
- Perform duties for the Contractor, or
- Interfere with either the Department's or the Contractor's management of the work.

INSPECTION SKILLS

OV1D-3 Inspector Skills

Introduction

As an Inspector, you are responsible for developing and using the skills required to inspect traffic control through construction work zones.

Skills

Skilled Inspectors are able to:

- Monitor traffic control for compliance with the plans.
- Ensure inspection, sampling, testing, and judgment of the Contractor's TCP implementation.
- Determine when the TCP is not working correctly.
- Clearly document the Contractor's progress in implementing the TCP and correcting deficiencies.

New Inspectors

New Inspectors should study and understand all of the inspection procedures in this manual to:

- Become familiar with the MUTCD, Part VI,
- Develop knowledge and skills, and
- Prepare for future responsibilities.

RESPONSIBILITIES OF AN INSPECTOR

OV1D-4 Inspector Responsibilities

Introduction

Your main responsibility as Inspector of traffic control is to protect the safety of workers and the traveling public, including pedestrians, and ensure efficient flow of traffic.

General Responsibilities

- Determine who is the responsible person for the contractor.
- Be familiar with all the traffic control devices.

Decisions

Your decisions must:

- Uphold the requirements and intent of the contract, plans and specifications; and
- Be fair, firm, and consistent.

Specific Responsibilities

Inspectors have the following specific responsibilities when inspecting traffic control:

- Thoroughly research and become familiar with the specifications, special provisions, and plans before beginning the inspection.
- Provide for the safety of motorists, pedestrians, and all personnel involved in the project.
- Perform both day and night inspections, during both peak and off-peak traffic conditions.
- Ensure that all traffic control devices adhere to the plans and agency standards. If not, bring them to the attention of the Project Manager and Contractor.
- Document in your project diary or other form every time you notify the Contractor of a deficiency, and report to your supervisor if the Contractor does not correct the deficiency on time.
- Reinspect traffic control on the dates the Contractor corrects deficiencies.
- Monitor the TCP closely to ensure that all signs and devices apply to the current conditions and construction phase.
- Instruct the Contractor to remove or cover all signs and devices that do not

apply to the current conditions or construction phase.

- Establish and maintain a harmonious working relationship with the Contractor's personnel, while maintaining a professional image.
- Maintain all reports and records your District and Residency requires.

Note: Inspectors might not perform all of the duties listed above, depending on District or Residency policy.

Module II. Inspection Basics

INSTRUCTION SUMMARY

Duration:

10 minutes

Objective:

To introduce the individual sections of Module II, and to get participants to better understand what will be required of them in the upcoming sections

Content:

Traffic Control Plans and Related Documents, Inspection Procedures,

Inspection Workshop

Equipment and Aids:

None

LESSON PLAN

"Introduction"

- The next few modules cover the basics of conducting an inspection.

"Traffic Control Plans and Related Documents"

- We will discuss the documents that relate to work zone safety inspections.
- How these documents can be used as part of an overall safety inspection program.
- The documents are important to use to maintain good practices.

"Inspection Procedures"

- We will cover the basic procedures of work zone safety inspections.
- A six-step process will be outlined that can be used or modified to provide an overall method for work zone inspection and maintenance.

"Inspection Workshop"

- In this module, the class will be split into groups.
- Each group gets work zone plans.
- How will you inspect this work zone?
- In part 2, later in the day, photographs of the work zone will be distributed.
- These will be used to determine discrepancies and deficiencies in the work zone.
- Near the end of the day, the class will discuss the results of the group inspections.

Module II. Inspection Basics

Participant's Notebook Text INTRODUCTION

Visual Aids
None

In this module, we will cover the basics of work zone safety inspections. The topics covered will provide a basis for development of an effective work zone safety inspection program. This module consists of three submodules described below.

Submodule II.A. Traffic Control Plans and Related Documents

In this submodule, we will discuss what documents relate to work zone safety inspections and how they can be used to help in the development and maintenance of a work zone safety inspection program. Also, the importance of the use and completion of documents related to work zone inspection will be discussed as it relates to good practices.

Submodule II.B. Inspection Procedures

The basic procedures of work zone safety inspections will be covered. A six-step process will be outlined that can be used or modified to provide an overall method for work zone inspection and maintenance. The six steps are: Preparation, Yard Inspection, Drive-Through Inspections, Stationary Observation of Traffic Operations, Walk-Up Inspections, and Documentation Procedures.

Submodule II.C. Inspection Workshop

In this module, the class will be split into groups. Each group will be given plans of a work zone and asked to describe a strategy for inspecting that work zone. Later, photographs of the work zone under consideration will be distributed and used to determine discrepancies and deficiencies in the work zone. At the end of this submodule the groups will convene to discuss the results of their work zone inspections.

Module II.A. Traffic Control Plans and Related Documents

INSTRUCTION SUMMARY

Duration:

30 minutes

Objective:

To describe and show the relationship of contract documents that will be used

by work zone safety inspectors

Content:

The following contract documents will be shown and discussed:

- Traffic Control Plan (TCP)

- Standard specifications

- Contract and special provisions

- Standard plans

- Manual on Uniform Traffic Control Devices (MUTCD)

- Other related documents:

- Documentation Record

- Order Record

- Change Order

- Certificate of Acceptance

Equipment:

Overhead Projector

Aids:

3 Overheads, Handouts of local jurisdiction's plan sheets

PRESENTATION OPTIONS

Overheads are used to list and illustrate the contract documents. The various documents are described and the relationship between them is discussed. A set of plans furnished by the agency is used as an example. The agency's standard specifications are also used.

LESSON PLAN

Prior to starting a construction project, the work zone safety inspector should become familiar with the contract documents that govern the project. The intent of the contract is to provide for the construction and completion of the work described in those documents.

OV2A-1 - "REVIEW OF CONTRACT DOCUMENTS"

Show the overhead and state the documents you will be showing and describing.

OV2A-2 - "CONTRACT DOCUMENTS GOVERN IN THE FOLLOWING ORDER"

Show the overhead.

These contract documents are complementary. A requirement in one document is binding as though occurring in all the contract documents. Requirements in the Standard Specifications are overruled by the requirements in the Plans. Requirements in the Plans are overruled by the requirements in the Contract and Special Provisions.

OV2A-3 - "LOCATE AND REVIEW THE FOLLOWING PLAN SHEETS"

The first document that we will discuss is the Traffic Control Plan.

Pass out TCP example.

The traffic control plan for one of your projects is being passed out.

We will go through the TCP and identify some of the sheets that pertain to the traffic control items. Find the INDEX OF SHEETS on the title page.

On the following lines, fill in the page numbers from the agency's sample TCP.

The traffic control sheets are on pages	•	 · · · · · · · · · · · · · · · · · · ·
The construction detail sheets are on pages _	-	
The project layout sheets are on pages	•	
Estimate and quantity sheets	 	
Device standard sheets	٠.	· · · · ·
TCP standard sheets or estimate summary sheets	•	

Show the standard specification book.

The Standard Specification Book has an agency's overall guiding specifications for road construction. The standard specifications are approved for general application and repetitive use. (Discuss section where most traffic control items are presented.)

Show the Special Provisions.

The Special Provisions are modifications to the standard specifications and are applicable to an individual project. They are also used to amplify and expand the information presented in the specifications. They may also present information on devices that are not in the specifications, for example, impact attenuators or radar speed advisory signs.

Show the standard plans in the TCP.

The standard plans are usually approved for repetitive use and may not be in the plans.

Show the MUTCD and Part VI of the MUTCD.

The MUTCD presents the national standard for traffic control devices. Part VI deals with temporary work zone situations.

Show an example of the Certificate of Compliance.

The Certificate of Compliance is provided by the contractor to prove that products delivered to the project meet your Department's material requirements.

Show an example of a Documentation Record.

The Documentation Record documents what was installed in the field and/or gives authority for those items to be installed. Payments to the contractor are made from this document.

Show an example of an Order Record.

The Order Record orders a contractor to do something and is required to ensure compliance by the contractor

Show an example of a Change Order.

The Change Order is used to get additional work done that may not have been in the original contract.

Now show the students how to track a couple of devices through the various documents. Ideally, you have received the plans in advance and have already found the appropriate sheets

for each device. Have this information written down and ready before the class presentation.

For example, in Part VI, Type III barricades are shown in Section 6F-5 (pp. 66-67). You may wish to have students find the sheets in the standard spec book or TCP that deals with Type III barricades. Familiarize students with the paper trail of work zone documentation and how they can use the various documents to determine discrepancies and deficiencies.

This module presented some of the contract documents with which you will be working. It is up to you to become familiar with these documents every time you start a new project so that you can refer to them when needed on the job.

VISUAL AIDS

OV2A-1 - REVIEW OF CONTRACT DOCUMENTS

- Traffic Control Plan.
- Standard Specifications.
- Contract and Special Provisions.
- Standard Plans.
- MUTCD.
- Other Documents Related to the Contract:
 - Documentation Record
 - Order Record
 - Change Order
 - Certificate of Acceptance

OV2A-2 - CONTRACT DOCUMENTS GOVERN IN THE FOLLOWING ORDER

- Contract and Special Provisions.
- Plans.
- Standard Specifications.

OV2A-3 - LOCATE AND REVIEW THE FOLLOWING PLAN SHEETS

Project TCP sheets

Device requirements including:

type location number

Construction detail sheets

Construction phases and traffic control item locations

Project layout sheets

Traffic control layout

Estimate and quantity sheets **or** estimate summary sheets

TCP separate pay items

Device standard sheets

Device requirements, such as:

size spacing general use

TCP standard sheets

Traffic strategies, such as: one-lane, 2-way traffic moving operations pavements

Module II.A. Traffic Control Plans and Related Documents

Participant's Notebook Text INTRODUCTION

Visual Aids

Prior to starting a construction project or assuming duties on an ongoing project, a traffic control inspector should be familiar with the contract documents that govern the project. The intent of the contract documents is to provide for the construction and completion of the work described in those documents.

OV2A-1
Review of
Contract Documents

The Contract Requirements, Plans, and Standard Specifications are contract documents. A requirement in one document is binding as though occurring in all the contract documents. The contract documents are intended to be complementary and to describe and provide for a complete contract. In case of discrepancy, calculated and shown dimensions govern over scaled dimensions. The contract documents govern in the following order:

OV2A-2 Contract Documents Govern in the Following Order

- Special Contract Requirements
- Special Provisions
- Plans
- Standard Specifications

The contract documents represent the agreement reached between the contracting agency and the contractor on the work to be performed and how the work is to be accomplished.

When the contract requires the contractor to operate in or adjacent to actual traffic or requires the contractor to provide for temporary control of traffic, the contract will contain a Traffic Control Plan (TCP).

TCPs can be elaborate detailed layouts and plan sets for major long-term projects or a simple reference to a single traffic control layout in the MUTCD for small projects. Most TCPs fall somewhere between these two extremes.

REVIEW OF CONTRACT DOCUMENTS

Traffic Control Plan (TCP)

Start with the first sheet of the plan to determine which sheets address the traffic control devices to be used on the project. Find the quantities of traffic control devices to be utilized. The contractor will get paid for installing and maintaining the items. These pages list the traffic control devices by specification number, pay item, pay unit, and quantity of devices. These are the items that you will be responsible for inspecting. Also, become familiar with the type of work and the construction phases

that will require changes in traffic control. Familiarization with these items will help you, when reviewing the traffic control plans, to see where the devices are located in the plans and in the field.

Locate and review the following plan sheets to determine the traffic control items to inspect.

OV2A-3 Locate and Review the Following Plan Sheets

Type of Plan Sheet	Inspection Concerns
Project TCP sheets	device requirements including: ■ type ■ location ■ number
Construction detail sheets	Construction phases and traffic control item locations
Project layout sheets	Traffic control layout
Estimate and quantity sheets or estimate summary sheets	TCP separate pay items Quantity of each device
Device standard sheets	Device requirements, such as: size,spacing, andgeneral use
TCP standard sheets	Traffic strategies, such as: one-lane 2-way traffic,moving operations, andpavement markings

Make notes during your inspection of any items identified above.

Review the above items using references, including:

- Standard specifications,
- Special contract requirements,
- Standard plans,
- The "Manual on Uniform Traffic Control Devices" (MUTCD),
- Other documents related to the contract,
- Checklists, and
- This manual.

Standard Specifications

The standard specifications are approved for general application and repetitive use. They are used primarily for constructing roads and bridges on projects under the direct administration of various highway departments. When designated in a contract, the specifications become part of the contract and binding upon all parties to the contract, that is, the highway or roadway agency, the contractor, and the subcontractors.

Review the specifications before the contract begins. Safety hardware items are listed by the specification numbers identified in the list of quantities. Remember that if there are discrepancies between the plans and the specifications, the plans override the specifications.

Special Contract Requirements (Contract and special provisions)

The special contract requirements (contract and special provisions) are modifications to the standard specifications and are applicable to an individual project. They are used to amplify and expand the information presented in the specifications. They may also present information on devices that are not presented in the standard specifications. For example, a contract requirement for an impact attenuator may not be listed in the specifications, but would be presented in the special contract requirements. Both standard specifications and special provisions can provide information on the acceptability/quality being required from the contractor for devices.

Standard plans

Standard plans are detailed plans approved for repetitive use and may or may not be included as part of the plans. They are approved in accordance with the specifications.

Manual on Uniform Traffic Control Devices (MUTCD)

The MUTCD presents standards and guides for traffic control devices. Part VI of the MUTCD addresses traffic controls for street and highway construction, maintenance, utility, and incident management operations. All work on public streets and highways requiring traffic control is governed by Part VI.

A State may have a similar MUTCD, but it must meet or exceed the standards presented in the FHWA MUTCD. If there are differences between a specific State's MUTCD and that of the FHWA, usually it is because the specific MUTCD exceeds the FHWA standards and requirements. Many States simply adopt the FHWA MUTCD or adopt it and also create their own supplement to it.

Other Documents Related to the Contract

Certificate of Compliance

In addition to making sure that all traffic control devices are properly installed and maintained, you also have to check that the devices themselves meet material requirements. For example, any one drum used for traffic control usually looks very similar to any of the other drums used. However, a highway agency will have requirements for the drum material and also the type of retroreflective sheeting used for the stripes on the drum.

Contractors are required to provide a certificate of compliance stating the materials comply with an established material specification. When a shipment of devices arrives at the job site, the contractor should furnish a product certification that the product was commercially produced to a standard specification.

Products accepted on the basis of a certificate of compliance may be sampled and tested at any time. If found not to be in conformity with the contract requirements, the product will be rejected, whether in place or not.

Documentation Record

The document record lists what was installed in the field or gives authority for it to be installed. Both the current and cumulative amounts of devices are recorded on the form. Payments to the contractor are made from the quantities noted on the documentation record.

Order Record

The order record directs the contractor to do something specific. Many times the contractor will perform the task upon request of the resident engineer. The order record is only used when it is necessary to get the contractor to comply with the request.

Change Order

A change order is used to get additional work done that may not have been included in the contract. Such an item might be something that was overlooked during preparation of the original plans, but is essential to the progress of the project. It is usually for major changes, including traffic control plan revisions. Quantity changes are included. Change orders take time to execute. If the additional work is needed because of an emergency, many times the work is done first with verbal approval, then the change order is completed.

SUMMARY

This module contained a review of the typical contract documents, including:

- \bullet TCP
- SpecificationsSpecial Contract Requirements
- Standard PlansMUTCD, Part VI
- Other Documents

These documents are an important part of work zone safety inspections. Inspectors must become familiar with them before the project begins.

Module II.B. Inspection Procedures

INSTRUCTION SUMMARY

Duration:

30 minutes

Objective:

To cover the steps that should be included in a comprehensive inspection program

Content:

Inspection Program. Step 1: Preparation, Step 2: Yard Inspection, Step 3: Drive-through Inspection, Step 4: Stationary Observation, Step 5: Walk-up Inspections,

Step 6: Documentation

Equipment:

Overhead Projector

Aids:

19 Overheads

PRESENTATION OPTIONS

The generalized procedure discussed should be supplemented with specific items from the sponsoring agency. For example, in Missouri there are three special provisions that relate to inspection schedules. Any similar provisions (dealing with any aspect of the inspection program) for the local jurisdictions for whom the course is being presented should be discussed, if available.

LESSON PLAN

Introduction

- What is part of an inspection program?
- Steps
- Inspection Tools (checklists)

OV2B-1 "Inspection Program"

- Must plan inspection
- Other parts include accident review

OV2B-2 "What Do Plans Call For?"

- Plans or other contract documents
- Specify what should be seen

OV2B-3 "What Has Contractor Furnished?"

- What inspector observes
- Should agree with contract documents

OV2B-4 "What Is The Condition of the TCDs?"

- Changes with time
- Judgment call
- Quality Standards are an aid

OV2B-5 "Six-step Procedure"

- From start of job to finish
- Not all steps will be done each day
- Documentation is critical-needed in litigation

OV2B-6 "Step 1"

- Big step for new inspectors
- May require little time by middle of job

OV2B-7 "Step 2"

- Meets specs, acceptable condition
- Inventory
- Not done often, but don't overlook

OV2B-8 "Quality Standards"

- Aid to judgment
- Three Conditions

OV2B-9 "Picture of three signs"

- Marginal is at lower end of acceptability
- Unacceptable seen too often in field

OV2B-10 "Device Quality and Condition"

- 100 % at start
- 75 % or more at anytime in field

- 12 hours to correct specified by ATSSA.

OV2B-11 "Step 3"

- Seeing zone as drivers see it
- Cover all routes through zone
- Videologging or pictures
- Key to location

OV2B-12 "Windshield View"

- Time to react
- General system
- Arrow Panel
- Note areas to check in more detail

OV2B-13 "Night View"

- Retroreflective Material
- Lights
- Markings
- Dim arrow panels or PCMS

OV2B-14 "Step 4"

- Elevated viewpoint
- Brakelights or swerving
- First vehicle in group or single vehicles

OV2B-15 "View from Overpass"

- Intersecting Vehicles
- Skid marks
- Vehicle actions

OV2B-16 "Step 5"

- Covered with each device

OV2B-17 "Picture of Inspector"

- English or metric?

OV2B-18 "Checklists"

- At end of each module
- Aid to being complete

OV2B-19 "Step 6"

- Steps
- Methods
- Corrections
- Discrepancies and Deficiencies
- Paperwork necessary in litigation

VISUAL AIDS

OV2B-1- INSPECTION PROGRAM

- · Plan
- · Defined Procedures--Schedule
- · Inspection Form
- · Repairs
- · Inventory
- · Accident or Incident Review
- · Drive-Throughs
- · Documentation

OV2B-2 - WHAT DO THE PLANS CALL FOR?

OV2B-3 - WHAT HAS THE CONTRACTOR FURNISHED?

OV2B-4 - WHAT IS THE CONDITION OF THE TCDs?

OV2B-5 - SIX-STEP INSPECTION PROCEDURE

- · Step 1-- Preparation
- · Step 2 -- Yard Inspection
- · Step 3 -- Drive Through
- · Step 4 -- Stationary Observation
- · Step 5 -- Walk-Ups
- · Step 6 -- Documentation

OV2B-6 - STEP 1-- PREPARATION

OV2B-7 - STEP 2--YARD INSPECTION

OV2B-8 - QUALITY STANDARDS

OV2B-9 - "Picture of Three Signs"

OV2B-10 - DEVICE QUALITY AND CONDITION

- · Traffic Control Devices in Work Zones Should Be:
 - 100% acceptable condition, or better, before taking to the site for installation.
 - 75 % of the devices should be in acceptable, or better, condition at any given time on the site.

OV2B-11-STEP 3--DRIVE THROUGH

OV2B-12 - "Windshield View of Work Zone"

OV2B-13 - "Night View of Work Zone"

OV2B-14 - STEP 4--STATIONARY OBSERVATION

OV2B-15 - "Picture of Stationary Observation of Work Zone"

OV2B-16 - STEP 5--WALK-UPS

OV2B-17 - "Picture of Inspector at Crash Cushion"

OV2B-18 - CHECKLISTS

OV2B-19 - STEP 6--DOCUMENTATION

- · Starting and Ending Time
- · Location
- · Type, Condition, and Position of TCDs
- · Personnel
- · Equipment
- · Changes in Regulatory Devices

Module II.B. Inspection Procedures

Participant's Notebook Text INSPECTION PROGRAM

A comprehensive inspection program includes the following items:

- · A formalized plan
- Defined inspection procedures
- A form on which the findings of the field inspection are recorded
- A repair/replacement/improvement program
- An adequate inventory of devices for emergency replacement or repairs
- · A procedure check to ensure specified repairs are made
- Identification of possible causes of accidents or skid marks
- A review to ensure the travel path is clearly marked through the entire work zone, both day and night
- · Formal documentation of inspection and repairs

The steps of the inspection program as discussed in this course are as follows:

- Step 1: Review of contract documents and preparation for inspection
- Step 2: Yard inspection
- Step 3: Drive-through inspection of traffic control zone
- Step 4: Stationary observation of traffic operations in traffic control zone
- Step 5: Walk-up inspections of major safety hardware items
- Step 6: Document inspection and check on needed changes or repairs

STEP I: PREPARATION

Good preparation prior to making inspections is essential, but the amount of preparation required depends on the familiarity you have with the work zone being inspected. Ask yourself the following questions:

- 1) Are you inspecting the work zone for the first day it is to be in operation?
- 2) Are you going to make the first inspection after a major phase change?
- 3) Are you performing an inspection where traffic control devices and safety hardware have been in place for several days or weeks?

Visual Aids

OV2B-1

Inspection Program

OV2B-2

What do the plans

call for?

OV2B-3

What Has the

Contractor Furnished?

OV2B-4

What is the Condition

of the TCDs?

OV2B-5

Six-Step

Inspection Procedure

OV2B-6

Step 1-Preparation

If the work zone is to be newly installed or you have not inspected this work zone before, you may need to spend one or two hours reviewing the contract documents. What devices are called for? Are you familiar with the application, operation, and maintenance of each of the specified devices? What work is to be accomplished during each phase?

Before you ever see the work zone, you should visualize it from the traffic control plan and other contract documents.

STEP 2: YARD INSPECTION

OV2B-7 Step 2—Yard Inspection

Before the TCP is implemented—and devices or hardware are installed in the field—the devices must be inspected to insure that they are accepted devices in acceptable condition. There must also be sufficient devices to meet the needs of the traffic control plan.

The basic size, color, and shape of traffic control devices are specified in the MUTCD. Many agencies have lists of approved devices such as attenuators, arrow panels, changeable message signs, etc. Your agency may require a specific type of sheeting on signs and channelizing devices (we will cover the basic types of sheeting later).

If the devices meet these requirements, then the next concern should be the condition of the devices. While a device does not have to be new, it should be in acceptable condition before being placed in service. A good reference for determining the condition of devices is the "Quality Standards for Work Zone Traffic Control Devices," published by the American Traffic Safety Services Association (ATSSA).

OV2B-8 Quality Standards

This guide contains the following general categories concerning the quality of a traffic control device:

OV2B-9 "Picture of three signs"

Acceptable

Devices that meet the quality requirements herein for this classification and all other requirements such as design, size, color, weight, etc. in the plans and specifications, shall be considered to be acceptable for use on highway construction or contract maintenance projects.

Marginal

The term "Marginal" for the purpose of this manual means "marginally acceptable," reaching the lower end of acceptability. Devices that meet the quality criteria for marginal as described herein may remain in the work

zone until their number exceeds the specified percentage of that type of device or until it is determined that they have become unacceptable.

Should the percentage of devices in the marginal category exceed the specified percentage, the proper number of those devices shall be replaced so as to bring the percent of marginal devices to the specified percentage or less.

Unacceptable

Devices in this category shall not be delivered to the jobsite. When found in the work zone, they shall be replaced or repaired within twelve hours of notification or as required in the contract specifications.

At the time of the initial setup (or at the time of major stage changes), the specified percent of each type of device (cones, tubular markers, drums, barricades, vertical panels, signs, warning lights, arrow panels, changeable message signs, pavement tape, and raised pavement markers) shall be classified as "acceptable." Throughout the duration of the project, the number of acceptable devices may decrease to an unacceptable level, as a result of damage and/or deterioration during the cause of the work with the remainder of the devices in the marginal category. Unacceptable devices or situations that are found on the jobsite shall be replaced or the situation corrected as specified in the contract specifications. Imminent danger situations require immediate correction (See 3. on Page 2B-7).

OV2B-10 Device Quality and Condition

A pocket-size ATSSA pamphlet contains photographs and descriptions of specific devices to determine if the device is acceptable, marginal, or unacceptable. Similar information is contained in the device module of this participant's notebook. Samples of each category of device can also be retained to assist you in determining which category a device is in.

STEP 3: DRIVE-THROUGH INSPECTION

A newly implemented work zone traffic control plan may not operate as well as it was designed to operate. To decrease hazards to motorists and workers, traffic controls should be inspected and evaluated immediately after the traffic control plan is implemented. The information learned during an initial work zone inspection may identify potential hazards that can be corrected before any accidents occur.

Two ways to perform the initial inspection are by driving through the work zone and by watching how traffic operates through the work zone. A drive-

OV2B-11 Step 3—Drive Through

OV2B-12
"Windshield View of Work Zone"

through inspection enables the observer to see the traffic control devices and perform the maneuvers required of other drivers. This kind of inspection should be done in all lanes, in both directions, or crossroads, during the day and the night, and from all entry or exit points within the zone. Any other routes, such as detours, that have work zone traffic on them should be driven also.

A tape recorder is a good way to document immediate thoughts and observations. Photographs, time-lapse film, video tape, or photologging are good for capturing both the driver's and a bird's-eye view of the work zone. Pictures have the advantage of being a permanent record of the traffic control plan as it is installed on the highway. All recordings and pictures should be keyed to the project by station or milepost and the particular traffic control plan. All records, including pictures, should be dated.

During the initial inspection, traffic control procedures should be compared with the plans and specifications. Signs should be evaluated to see if they communicate their message and are properly located. The location and length of lane tapers and the spacing of devices should be checked. Any work zone traffic signals should be checked to see that they are operating properly, or will operate properly (i.e., dimming photo cell). Any existing signs or signals that are not needed should have been removed or covered. By this time, all proposed pavement markings should have been applied and nonapplicable pavement markings removed if the work zone is stationary and of sufficient duration.

If <u>flaggers</u> are used, their <u>performance</u> and <u>appearance</u> should be checked to see that they are using the proper flagging techniques and are wearing reflective vests and hard-hats. More important, a determination should be made whether the work zone can be operated efficiently without flaggers. If so, flaggers need not be exposed to additional hazards. If other workers are in the area near the traveled way, they should be properly dressed and instructed to avoid unnecessary exposure to traffic. Work vehicles should be parked far enough away from the traffic, and private vehicles off the job site or in designated areas.

The initial inspection should include a night visit to the work zone. The entire arrangement of traffic control devices should be checked to determine if the devices properly delineate the path through the work zone. Any signing that is not needed after the workday ends should be covered. All steady-burn and flashing hazard lights should be working properly. Any reflective material used for signs and barricades should be clean and bright. New pavement markings should be bright and should delineate the pavement boundaries. All evidence of unwanted pavement markings should be removed so drivers will not be misled to follow the

OV2B-13
"Night View of Work Zone"

wrong, and possibly dangerous, path. Results of the night inspection should be compared with the day inspection results.

STEP 4: STATIONARY OBSERVATION

Traffic flow patterns can also be observed from a position along the shoulder of the roadway. A fixed observation point allows the traffic control inspector to see vehicles on a particular portion of the work zone. If the observer is unable to view the entire work zone from one position, separate observations from different positions will be needed. Other vantage points, such as overpasses, hillsides, buildings, or even airplanes, may offer better views of the entire traffic flow pattern, but you should try to remain unnoticed.

OV2B-14 Step 4—Stationary Observation

A stationary observation should be done or repeated during the following conditions:

OV2B-15
"Picture of Stationary
Observation of Work
Zone"

- · When equipment is operating adjacent to the traffic
- · When materials are being moved on or off the job site
- · During rush or peak traffic flow
- · When shifting, traffic for different phases of work
- · During inclement weather, such as rainstorms
- Day-Night operations, particularly when work lights and/or equipment must operate adjacent to traffic

STEP 5: WALK-UP INSPECTIONS

Many major devices such as attenuators and variable message boards cannot be completely inspected by a drive-through inspection. These major devices will need to be inspected closely to assure correct operation. Also, inspectors must ensure during walk-up inspections that the assembly and/or installation of work zone devices is done according to the plans, specs, and/or manufacturer's recommendations. The specific steps for a walk-up inspection of each device are given in the individual modules.

OV2B-16 Step 5—Walk-Ups

OV2B-17
"Picture of Inspector at Crash Cushion"

STEP 6: DOCUMENTATION

The primary purpose of documenting accident information is to evaluate the effectiveness of the TCP and determine if changes are required. Also, the key to defending work zone traffic cases in courts of law is advance preparation. Highway personnel and contractors should maintain a careful record of job-related activities, so they may document their efforts of providing good traffic control at

OV2B-19 Step 6— Documentation the worksite. The record system should reflect priorities and a planned safety program.

Documentation Steps

The following steps are recommended as a means of establishing effective project documentation:

- · Maintain up-to-date engineering drawings.
- · Maintain change orders on major changes to the TCP.
- · File all pertinent memoranda and correspondence.
- · Reference standards and specifications.
- Maintain personnel training records as basis for inspector's qualifications.
- · Keep a daily project diary.
- · Perform and document all inspections.
- · Follow all safety regulations.
- · Conduct personnel safety training.
- · Document all instructions to contractors or subcontractors.
- · Take photographs of key project stages and unusual situations.
- In case of an accident, project personnel should promptly record and document circumstances and pertinent factors. Photographs are recommended.

Documentation of Field Records

The time and location of the installation and removal of traffic control devices is needed for good record-keeping procedures. Although this can be time consuming for a moving maintenance operation, it is important to record significant traffic control actions taken by the field crew, including the following:

- · Starting and ending time of work
- Location of work
- · Type, condition, and position of traffic control devices
- Names of personnel
- Type of equipment used
- · Any change in temporary or permanent regulatory devices

Documentation of Correction

When the inspection process reveals a condition that requires correction, the documentation should include the following:

- · A description of the correction needed, when it was noted, and by whom
- · Corrections made or deferred and why
- · Replacements made or deferred and why
- · Any other needed actions

Recording Methods

Major projects will require more detailed record keeping because they may involve greater amounts of funds; outside funding sources, such as Federal or State aid; and longer distances and times of physical exposure to the workers, motorists, or pedestrians.

Several methods of recording traffic controls are available, including the following:

- Photologging
- Photographs keyed to a diary containing a brief description of time, location, direction, and photographer's name
- Special notes on construction plans, preferably the traffic control plan sheet
- Daily diary entries of times, locations, and names of individuals involved in the installation, change, and removal of traffic control devices
- · Videotaping at the initial setup of the work zone and periodically thereafter when changes in TCP or construction stages occur

Change orders or work orders also serve as a reference and should be keyed to the diary when used.

Resolution of Discrepancies and Deficiencies

In spite of the best intentions of department staff and contractors, situations occasionally arise where the contractor's inspection of safety hardware or other items of work does not measure up to the department's expectations. In such cases, specific steps must be taken by the department to obtain contractor compliance with the contract requirements. It is essential that the steps taken are consistent with the terms and provisions of the contract and department policies and procedures. In particular, the contractor must be given proper notice of deficiencies and an opportunity to connect them.

While the specific actions must be based on the circumstances of the particular project situation, there are a number of basic steps that must be followed for the procedure to be effective in obtaining the desired results. It is expected that sound, businesslike management of all contracts will routinely result in compliance with all contract requirements without the need to proceed past the first few steps. In the normal order they occur, these include:

- Inform the contractor of noted deficiencies, document in project records.
- 2. Follow up to ensure deficiency is connected.
- 3. Imminent Danger situations (high likelihood of serious accident) require immediate connective action or work stoppage.
- 4. Verbal instructions when appropriate, progressing to written notice.
- 5. Construction department kept informed.
- Project-level meeting with Construction department participation for deliberate or willful deficiencies of a serious nature, with Main Office notification.
- Withholding payments and/or ordering dismissal of uncooperative or incompetent workers.
- 8. Ensure connection of safety hardware deficiencies, and/or recommending work stoppage.
- 9. Payment deductions, liquidated damages for deficiencies.
- 10. Regional District Meeting, with notice of possible termination.
- 11. Main Office Meeting with Deputy Chief Engineer (Construction).
- 12. Contract Review Unit review of contractor responsibility.
- 13. Contract Termination.

INSPECTION CHECKLIST -- Inspection Procedures

	Inspected / /	Inspector:		
Loca	ation of Work Zone:	Mile Post and Roadway or Job Number	, , , , , , , , , , , , , , , , , , , 	
		Time I out and I out way of 100 I turnoof		
Any	questions answered NO) should be discussed with supervisor.		
PR	EPARATION:		YES	NO
1.		ol plan and discuss with engineer. Does the plan agree with the contractor's anticipated	# Section (Control of the Assessment)	
2.		firmed contact with both contractor and ency contact persons?	**************************************	
3.	Have all signs and ba emergency phone nu	arricades been checked to ensure that mbers are on them?	-	
4.	Has the work zone pe pedestrians/bicyclists	rovided accommodations for s if necessary?		-
YA	RD INSPECTION:			
l.	Do all devices meet l	MUTCD specifications?		
2.	Are 100% of the dev	ices in acceptable condition?		
3.	Is the number of devias designed?	ices sufficient to install the TCP in the field		
4.	Are there sufficient s crash cushions?	pare parts in stock or quickly available for	· · · · · · · · · · · · · · · · · · ·	
DR	IVE THROUGH INS	PECTION:		
Ov	erall Traffic Control	Within Project Limits		
· l.	•	rkings in good condition and providing formation for drivers?	all of the second secon	
2.	Is the roadway surface	e in good condition?		
3.	Is there proper clear : points?	zone distance behind construction access	***************************************	
4.	Is all construction eq presenting a hazard t	uipment stored in safe locations and not o passing vehicles?		
5,		messages displayed on all CMSs		

	Concrete barrier:		
	Type of end protection (if any): Condition of temporary delineators:		
	Condition and clearance of lateral clearance markers: Flare rate:		
Temp	orary Traffic Control		
Any	questions answered NO should be discussed with supervisor.	YES	NO
1.	Is the lane closure set up per the contract's special provisions as far as hours of the day, number of lanes?	-	
2.	Is the traffic control correct according to an approved TCP?		
3.	Are all temporary signs and arrow boards clean and in good condition and do the signs display acceptable reflectivity?		
4.	Are traffic control devices visible to approaching traffic?		
5.	Are the appropriate channelizing devices setup, and do they employ the proper taper rates?		
6.	Are the channelizing devices clean and in good condition and do they display acceptable reflectivity?		
7.	Are the channelizing devices spaced appropriately according to the TCP?		
8.	Are the appropriate provisions made for pedestrian/bicycle traffic?	degra la compa	
9.	Are the appropriate provisions made for State Patrol/law enforcement assistance?		
10.	Are flagging operations in place and operating smoothly as called for in the TCP?		
11.	Are traffic control devices appropriate for current plans? Should existing signs in or near the work area be covered?		**************************************
STA	ΓΙΟΝΑRY OBSERVATION		
9. 10. 11.	traffic? Are the appropriate provisions made for State Patrol/law enforcement assistance? Are flagging operations in place and operating smoothly as called for in the TCP? Are traffic control devices appropriate for current plans? Should existing signs in or near the work area be covered?		· ·

Are traffic backups occurring?	
WALK-UP INSPECTIONS NEEDED	•
Place checkmarks by devices for w	which walk-up inspections were performed:
Flagger/Devices Signs PCMSs Arrow Panels High Level Warning Device Channelizing Devices Marking/Delineators	Portable Concrete Barrier
DOCUMENTATION	
Place checkmarks by the types of c	documentation obtained:
Photographs Notes on Plans Diaries	Videotaping Corrections Noted
For questions answered NO, state t	the question number and problem:
State the action resulting from que	stions answered NO:
Time and date that the problem wa Signature and Title:	as resolved:

Module II.C. First Inspection Workshop

INSTRUCTION SUMMARY

Duration:

40 minutes

Objective:

To get participants actively thinking about the inspection process, and to prepare

them for doing an "actual" work zone inspection using photographs in Part 2 of the

Inspection Workshop.

Content:

In-class exercise; no written content

Equipment:

None

Aids:

Sufficient number of the "First Inspection Workshop Instructions" handouts for all

classroom students.

Handouts of local jurisdiction's plan sheets Agency's specifications and special provisions

PRESENTATION OPTIONS

The time of this session may vary depending on how enthusiastically the students are participating, and how quickly the earlier Module II sessions were completed. You will need to have handouts made from the instruction sheet that follows this page. The instructions and questions to be answered can be varied based on the plan sheets being reviewed. H2C-1 on the following page is a specific example. This handout could be changed by specifying that the project has just started, and by asking different questions that could be answered from the plan sheets, special provisions, etc.

First Inspection Workshop

Using Contract Documents

Situation:

You have been assigned to inspect a project for the first time tomorrow. Traffic controls on this project are installed and the first phase of work has been underway for 3 months. Use your notebook, plans, standard specifications, and special provisions.

Instructions:

- 1. List the steps you would take in inspecting this zone and be prepared to discuss them with the class.
- 2. Using the contract documents given to you, determine:
 - a. How many Arrow Panels are on the job?
 - b. Is flagging anticipated?
 - c. How many phases?
 - d. What lane closure restrictions are there on the job?
- 4. Where did you find the above information?
- 5. How often are inspections required?

Module II.C. First Inspection Workshop

Participant's Notebook Text SURVEY AND PREPARATION

Visual Aids H2C-1

You have been assigned to inspect a project on a nearby work zone for the first time tomorrow. Traffic controls on the project have been installed and you will be provided with information on the current phase and duration of work. Traffic control plans for the project will be provided for you to prepare your inspection procedures. You are to list the steps you would take in inspecting this zone and be prepared to discuss them with the rest of the class.

Module III.A. Nighttime Traffic Control

INSTRUCTION SUMMARY

Duration:

10 minutes

Objective:

To make participants aware of the importance of visibility of traffic control devices

at night

Content:

Proper work zone design, factors affecting night work zones, factors affecting vision

and visibility, methods of improving nighttime work zone traffic control, importance

of maintaining devices.

PRESENTATION OPTIONS

The presentation method for this session is to show a video that comprises portions of the American Traffic Safety Services Association (ATSSA) and FHWA videos. This video covers the material in the participant's notebook.

LESSON PLAN

1. Video presentation

Devices such as signs, channelizing devices, pavement markings, and even flaggers rely on bright colors to be visible during the daytime. However, at night these devices must be retroreflective to be visible. So there is an emphasis on making sure that devices being used at night are visible to drivers and provide the proper path delineation through the work zone. Any time traffic controls are on the road at night, they must be inspected at night.

I am going to show a video on nighttime delineation. It was produced by ATSSA. It has been edited to reduce its length. Material on maintenance of devices from a FHWA video has been added.

VISUAL AIDS

1. Video presentation - ATSSA/FHWA video

Module III.A. Nighttime Traffic Control

Participant's Notebook Text INTRODUCTION

Visual Aids
ATSSA Videotape

Driving in work zones can be hazardous during daylight, but nighttime lighting can make this experience a driver's nightmare. Many factors contribute to the difficulties that motorists experience at night. Factors such as dirty traffic control devices, impaired nighttime visual acuity with age, and inclement weather conditions that decrease the effectiveness of traffic control devices can all contribute to make the nighttime driving scenario a dangerous one.

PROPER WORK ZONE DESIGN

To alleviate these problems, proper work zone design is vital. In addition, it is vital that work zones appear on the road in the manner that the designers and project engineers intended. For this reason, nighttime inspections of work zones are critical. To promote conformity, and therefore improved adherence to drivers' expectations, night work zone design must be based on standards and guidelines in Part VI of the MUTCD.

Part VI of the MUTCD, however, has several simplifying assumptions:

- 1) "Normal Conditions"
- 2) "Average" Driver
- 3) Typical applications
- 4) Minimum standards
- 5) Daytime work

As a result, Part VI cannot account for all situations. Some flexibility is left to designers to consider other factors.

FACTORS AFFECTING NIGHT WORK ZONES

Many factors affect night driving in work zones, and consequently must be considered during work zone design. First, drivers use low beams almost exclusively. Second, headlights are aimed toward the right; traffic control devices on the left may receive only 60% as much light as those located on the right side of the road. Also, rain, fog or other conditions are often present and serve to dissipate light from headlights. Dirt, dust, and grime on devices can reduce their brightness by 50%.

Finally, driver characteristics greatly affect driver capabilities at night in work zones. For example, young drivers are inexperienced and often easily distracted. Older drivers need much more light to see as well, and some drivers are impaired -- by alcohol, drugs, or other disabilities -- and may need more perception and reaction time. Also, a driver's familiarity with the area where work is occurring plays a significant role in driver performance. Drivers unfamiliar to the traffic patterns are more easily confused.

What these factors all boil down to is that safety levels drop with each factor that affects night work zones; the assumptions of the Manual represent a "best-case" scenario.

TWO MAIN FACTORS

Vision -- This refers to the capability of the driver to see work zone objects. It includes the following factors:

- Eyesight, visual acuity
- Quality of eyeglass lenses
- · Low/high beams; quality and brightness of headlights
- Dirt on windshield and windshield tint
- Rain, snow, fog
- Vehicle design (headlight/driver location)

Visibility -- This refers to a traffic control device's ability to get the driver's attention. It is affected by the following factors:

- Target value--based on size of device.
- Brightness of device.
- Positioning of device affects its ability to catch and retroreflect light.

METHODS OF IMPROVING NIGHTTIME WORK ZONE TRAFFIC CONTROL

In attempting to improve nighttime work zones, highway departments must be aware of the fact that **they can only improve visibility, not vision**. As a result, inspectors must ask themselves several key questions when designing a work zone that will be in operation at night. Are the traffic control devices adequately visible? Can they be easily seen? Do they command attention?

Several methods are available to improve visibility of night work zones:

- 1) Adding lights
- 2) Arrow panels
- 3) Cones with retroreflective collars
- 4) Workers wearing retroreflectorized vests
- 5) Adding steady-burn warning lights or reflectors to channelizing devices
- 6) Retroreflective sheeting
- 7) Retroreflectorized flags for flaggers
- 8) Lighted flagger station
- 9) Retroreflectorized clothing that outlines shape of body
- 10) Delineators
- 11) Lighted work areas
- 12) Lighted traffic areas
- 13) Glare screens

Improved visibility means improved safety. Consequently, constant monitoring and maintenance -- and a closely followed inspection schedule -- is critical for successful nighttime work zones.

Several things must be remembered when inspecting nighttime work zones. First, there is no such thing as a "Maintenance-Free" work zone. Signs, cones, drums, and vertical panels need frequent, regular cleaning. The position of traffic control devices must be checked and re-checked. Another important strategy is driving through the work zone and checking for sight obstructions. Warning and other lights must be checked for burned-out bulbs and changed when necessary or when they become less effective. Remember, what is visible to an inspector may not be adequate for other drivers in inclement weather. RPMs, pavement markings, and roadside delineators, if used, must be checked and replaced if lost.

SUMMARY

In summary, the best level of service is required of night work zones for safety, as well as tort liability, reasons. Nighttime work zone designs and inspections must take into account site-specific conditions present at the work zone site. Designs must be beyond standards or minimums for use at night, and for best performance, state-of-the-art work zone traffic control devices and strategies must be used. In other words, nighttime work zone traffic control must be designed and maintained as if peoples' lives depend on it.

Module III.B. Retroreflective Sheeting

INSTRUCTION SUMMARY

Duration:

15 minutes

Objective:

To familiarize participants with the types of and inspection techniques for reflective

sign sheeting

Content:

Types of reflective sheeting, engineering grade, super-engineering grade, prismatic,

high-intensity, and diamond grade

Equipment:

Overhead Projector

Aids:

4 overheads

PRESENTATION OPTIONS

The participant's notebook information was developed from information available provided by various sign sheeting manufacturers. Some agencies have differing standards concerning acceptable types of reflective sign sheeting. If nothing specific to the agency is available, question participants about how their agency is different.

LESSON PLAN

Introduction

- Retroreflective sheeting is covered in Module III of the Participant's Notebook.
- This presentation covers the second submodule on retroreflective sheeting.

OV3B-1 - RETROREFLECTIVE SHEETING

- The two most important inspection items for retroreflective sheeting are to check its type and condition.
- The type of sheeting is often specified in the TCP; some agencies have standard specifications that require a certain minimum type.
- This module will offer information that will allow inspectors to determine the various types of sheeting.
- Also, we will cover various aspects of retroreflective sheeting conditions and the special problems that arise under these conditions.

OV3B-2 - RETROREFLECTIVE SHEETING TYPES

- The FP-92 specs provide the type definitions for the following six types of sheeting:
 - Type I is engineering-grade, low-intensity; rarely used for work zone devices because it is not bright enough.
 - Type II is super-engineering grade, made by Nippon Carbide Industries featuring a star watermark to distinguish it from engineering grade.
 - Type III is 3M High-Intensity distinguished by a hexagonal pattern.
 - Type IV is prismatic, employing cube-corner retroreflectors. This surface pattern can be seen with the naked eye. Stimsonite prismatic is Type IV.
 - Type V is defined as a "...super-high intensity sheeting. A metallized microprismatic element material." in the FP-92. No example of this type of sheeting.
 - Type VI is also prismatic; definition is in Participant's Notebook. 3M Diamond Grade is Type VI.
- Sheeting types differ in reflective and durability characteristics
- Generally, contracts specify Type III or better high-intensity sheeting; diamond grade is still fairly rare.
- The TCP must be used to determine if a particular type of sheeting is required on a certain job.
- As always, the best and easiest test of the effectiveness of retroreflective sheeting is a nighttime drive-through.

OV3B-3 - Photo of Engineering Grade Sheeting

- Type I sheeting.
- No Identifying marks are apparent.
- Type II sheeting looks similar, except for star watermark. More beads are evident under microscopic inspection.

OV3B-4 - Photo of High-Intensity Sheeting

- Type III.
- 3M trademarked item.
- Watermarks that detail the proper application of the sheeting are described in the notebook:
 - Vertical Panel
 - Reboundable
 - Cone Sheeting

OV3B-5 - Photo of Stimsonite Prismatic and 3M Diamond Grade Sheeting

- Stimsonite Type IV.
- 3M Type VI.
- Differences in surface pattern are apparent.
- The sheeting market is rapidly evolving; new and different sheeting designs are likely to be encountered regularly.

OV3B-6 - RETROREFLECTIVE SHEETING CONDITION

- Retroreflective sheetings must be clean and in good condition to perform properly.
- Check that sign sheetings contain a black legend on an orange background.
- The real test of any retroreflective device is whether it is clearly legible to approaching drivers. Note that "legible" is not always the same as "visible." In other words, check that the retroreflective devices in a work zone convey the proper message to drivers, and that any deterioration they may have suffered does not impair comprehension of that message.
- Retroreflective sheetings in the workzone must be free from noticeable color fading. Faded colors can make a construction zone sign appear as a guide sign in color, thus reducing the effectiveness the sign message is to convey.
- Retroreflective devices must appear to be the same color, day and night, with the exception of the fluorescent sheetings discussed in the Notebook text.

VISUAL AIDS

OV3B-1 - RETROREFLECTIVE SHEETING

- Types
- Condition

OV3B-2 - RETROREFLECTIVE SHEETING TYPES

- Do work zone devices have approved sheeting as specified in the TCP?
 - FP-92 Specifications (Next Revision of MUTCD)
 - Six Types
 - Type I Engineering Grade
 - Type II Super-Engineering Grade
 - Type III 3M "High-Intensity"
 - Type IV Stimsonite Prismatic
 - Type VI 3M Prismatic "Diamond Grade"

OV3B-3 - "Photo of Engineering Grade Sheeting"

OV3B-4 - "Photo of 3M High-Intensity Sheeting"

OV3B-5 - "Photo of Comparison Between 3M Prismatic Diamond Grade and Stimsonite Prismatic Sheeting"

OV3B-6 - RETROREFLECTIVE SHEETING CONDITION

- Are retroreflective sheetings on work zone devices clean and in good condition, with a smooth, sealed surface?
- Do all construction zone sign sheetings contain a black legend on an orange background?
- Are retroreflective devices clearly legible to approaching drivers?
- Are retroreflective sheetings in the work zone free from noticeable color fading?
- Do retroreflective devices appear to be the same color, day and night?

Module III.B. Retroreflective Sheeting

Participant's Notebook Text INTRODUCTION

Visual Aids
OV3B-1
Retroreflective Sheeting

Retroreflective sheeting is a very important part of any work zone that remains in place for even one overnight period. Retroreflective sheeting makes devices that are otherwise invisible to motorists stand out and command attention and respect. There are several types of retroreflective sheeting, which we will examine in this chapter.

Do work zone devices have approved sheeting as specified in the TCP?

OV3B-2 Retroreflective Sheeting Types

All signs used at night shall be either retroreflective or illuminated. In general, construction zone warning signs should all be retroreflective, unless otherwise specified in the TCP. Several manufacturers make a wide variety of retroreflective sheetings. These sheetings vary greatly in pattern, reflectivity, and terminology. However, the Federal Specifications (FP-92) breaks the available sheetings into six distinct types. Note that these six retroreflective sheeting types are also planned for inclusion in the next revision of the MUTCD. The following quote from the FP-92, section 718.02, page 646 defines the six types. The text following the quote will explain the types in more detail, particularly how to identify sheeting of each type:

Retroreflective material is typed as follows:

- (a) Type I. A medium intensity sheeting. An enclosed lens glass-bead material.
- (b) Type II. A medium-high intensity sheeting. An enclosed lens glass-bead material.
- (c) Type III. A high intensity sheeting. An encapsulated glass bead or prismatic material.
- (d) Type IV. A high intensity sheeting. An unmetallized microprismatic element material.
- (e) Type V. A super-high intensity sheeting. A metallized microprismatic element material.
- (f) Type VI. An elastomeric high-intensity sheeting. A vinyl microprismatic material.

In common parlance, Type I sheeting is more commonly referred to as engineering grade sheeting. Engineering grade sheeting simply consists of an adhesive back surface, with a coating of glass beads on its front surface. There are no identifying marks or symbols on this sheeting. An example of the surface pattern of this type of sheeting is shown in Figure 3B-1.

OV3B-3
"Photo of
Engineering Grade
Sheeting"

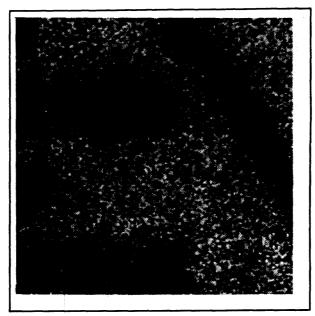


Figure 3B-1. Engineering grade sheeting.

Type II sheeting is often referred to as "super-engineering" grade sheeting. Its surface pattern looks similar to engineering grade sheeting when viewed with the naked eye. Under a microscope, a significantly larger amount of beads per unit surface area can be discerned with this type of sheeting than with engineering grade. This material is made by one specific manufacturer (Nippon Carbide Industries), and can be identified by a star watermark on the face of the sheeting.

Many agencies specify that work zone devices should employ "high-intensity" retroreflective sheeting. This generally refers to Types III-VI. There are several different types of sheetings from separate manufacturers that fit into this category. 3M has a trademarked "High-Intensity" sheeting, which is a Type III sheeting. This sheeting may be distinguished by the distinctive hexagonal pattern on its surface. This surface pattern is illustrated in figure 3B-2.

In addition, a variety of "worker symbols" are apparent on the surface of 3M's Type III High-Intensity sheeting. These symbols vary based on the type of devices which the sheeting is to be used on. The symbols, grouped by device on which they are to be used, are summarized below:

- Drums, other "reboundable" plastic devices Worker symbol NOT contained within a circle.
- Signs, Barricades, Vertical Panels, Regulatory Signs Worker symbol contained within a 3/8" circle.
- Cones Worker symbol contained within a triangle.

OV3B-4
"Photo of 3M High-Intensity Sheeting"

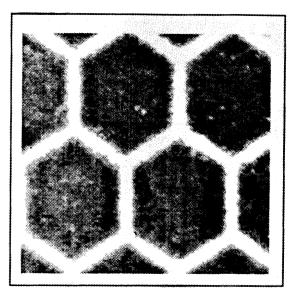


Figure 3B-2. 3M high-intensity sheeting.

Figure 3B-3 shows examples of the worker symbols.

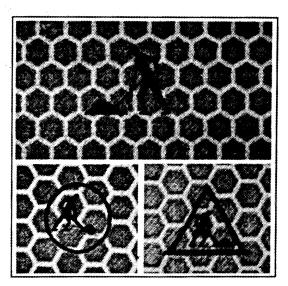


Figure 3B-3. 3M sheeting worker symbols.

Brighter sheetings are also available. These make up the Type IV, V, and VI sheetings. Most of these sheetings are prismatic in nature. These employ an array of tiny cube-corner retroreflectors in a coating on the surface of the sheeting.

An example of Type IV sheeting is Stimsonite's prismatic sheeting. Also, 3M makes a Type VI prismatic sheeting called "Diamond Grade". The different patterns of these sheetings are illustrated in figure 3B-4.

OV3B-5
"Photo of Comparison
Between 3M Prismatic
Diamond Grade and
Stimsonite Prismatic
Sheeting"

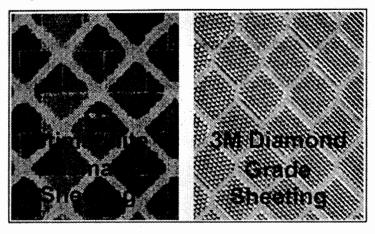


Figure 3B-4. Types of prismatic sheeting.

As mentioned before, there are a wide variety of sheeting types available, not all of which are described here. Check the TCP to ensure that the retroreflective sheeting material used on devices you are inspecting in a work zone is approved for use on those devices.

Are retroreflective sheetings on devices clean and in good condition, with a smooth, sealed surface?

OV3B-6 Retroreflective Sheeting Condition

To inspect the general condition of the retroreflective sheeting, see that the sheeting is clean and in good condition, and has a smooth, sealed surface. The surface of the sheeting should be checked for significant residue, peeling, cracking, or other signs of deterioration.

Do all construction zone sign sheetings contain a black legend on an orange background?

Are retroreflective devices clearly legible to approaching drivers?

Construction zone signs should have sheeting with black letters on an orange background and all other sign sheetings should conform to what is shown in the TCP. When driving through the work zone, look at any retroreflective devices; try to understand them and read any signs present. Be sure that all devices are legible from distances that allow motorists passing through the work zone time to take appropriate actions.

Are retroreflective sheeting surfaces free from noticeable color fading? Do retroreflective sheeted devices appear to be the same color both during the day and at night?

Color fading is another common problem that must be checked. Often, sign sheeting can appear to be perfectly acceptable during the day, but can undergo a significant color shift under headlight illumination at night.

Note that there are new fluorescent retroreflective sheetings appearing on the market that undergo a color shift under headlight illumination at night, even when in new condition. This phenomenon is a function of the fluorescent properties of the sheeting and does not indicate a defect. However, this sheeting is fairly rare at this time. If this type of sheeting appears on a job you are inspecting, check with the project engineer to determine if this is acceptable. Otherwise, sheetings which undergo significant color shifts at night are unacceptable and should be replaced.

INSPECTION CHECKLIST -- Retroreflective Sheeting Date Inspected __/ _/ Inspector: _____ Location of Device: Mile Post and Roadway or Job Number Any questions answered NO should be discussed with supervisor. YES NO 1. Do work zone devices have approved sheeting as specified in the TCP? 2. Are retroreflective sheetings on devices clean and in good condition, with a smooth, sealed surface? 3. Do all construction zone sign sheetings contain a black legend on an orange background? 4. Are the retroreflective devices clearly legible to approaching drivers? 5. Are retroreflective sheeting surfaces free from noticeable color fading? 6. Do retroreflective sheeting devices appear to be the same color during the day and at night? For questions answered NO, state the question number and problem: State the action resulting from questions answered NO: Time and date that the problem was resolved: Signature and Title:

Module IV. Flagging Inspection

INSTRUCTION SUMMARY

Duration:

15 minutes

Objective:

To describe points that should be covered when inspecting flaggers

Content:

Equipment, Visibility, Flagger Conduct, Warning Signs, Dangerous Situations

Equipment:

Overhead Projector, VCR

Aids:

2 Overheads, 8 minute Videotape

PRESENTATION OPTIONS

The first overhead of a flagger in a lawn chair can be used to introduce flagger inspection. The danger of flagging and the need to inspect flaggers should be emphasized.

The video can be shown after the introduction to cover most inspection points. The second overhead of Table VI-1 can be shown after the videos to expand on a point about flagger visibility. If plans from the agency show flagger operations, this overhead may not be needed.

LESSON PLAN

Introduction

Flagging is a dangerous job that should only be done when necessary.

OV3-1 Flagger In Lawn Chair

- Has no escape path.
- Probably could not move if something happened.
- Fatality waiting to happen.

Video - 8 minutes

This video covers several points that should be inspected in a flagging operation. It was taken from flagger training videos of the Iowa and Maryland DOT's. You (or someone in the audience) may notice that the flag in the video is not weighted according to the MUTCD requirements. Also, the STOP/SLOW paddle in the video is in poor condition. You may want to ask the class questions after the video, such as, "Was the flagging equipment shown in the

video acceptable? If not, why not?" Explain why these deficiencies should be corrected if they are observed in the field.

OV3-2 Table VI-1 MUTCD

- Distances discussed in video.
- Locates flagger station.

VISUAL AIDS

OV3-1 Picture of flagger in lawn chair

OV3-2 Table VI-1 MUTCD

Flagger video - 8 minutes

Module IV. Flagger/Devices

Participant's Notebook Text INTRODUCTION

Visual Aids
See Above

Flagging operations are most often used in situations where traffic must alternate over one open lane. The most frequent application is probably on two-lane, two-way rural roads where one side of the road must be closed for reconstruction or repair.

While this course is not intended to detail all aspects of flagger conduct and operation, it is important for inspectors to be aware of the major safety issues regarding flagging devices and procedures.

Is the flagger located properly as shown in the TCP?
Is the flagging equipment used of the proper size and color as shown in the TCP?

The TCP should spell out several characteristics of a flagging operation. Check the work zone operation against the TCP to ensure that the flagger is located properly, that the proper flagging equipment is being used, and that any such equipment is of the proper size and color as specified in the TCP.

Do flagging paddles used meet the requirements of the MUTCD?

Generally, hand-signalling devices are used by flaggers to control traffic through temporary traffic control zones. The two most commonly used devices are the Stop/Slow paddle, and a flagger's red flag. The Stop/Slow paddle is the appropriate device. It is required by the MUTCD because it provides more guidance to drivers than does the red flag.

Stop/Slow paddles should:

- Be at least 450 x 450 millimeter (18 x 18 inches) with an octagonal shape.
- Be made of a semirigid material such as sheet metal.
- Have reflectorized faces if used at night.
- Have a red background with a white border and STOP in white letters on one side.
- Have an orange background with a black border and SLOW in black letters on the other side.
- Be consistent with the requirements of the MUTCD.

Preferably have a handle approximately 1.5 meters (5 feet) long.

Is the flagger location visible to oncoming traffic at a sufficient distance to allow drivers time to respond to flagger's signal?

It is very important for the safety of the flagger, the workers, and the motorists, that there is ample time for motorists to recognize the presence of a flagger, and also to interpret the message that the flagger is intending to send. Drive through the work zone both during the day and at night (if the flagging operation continues during night hours) to ensure that this is the case, and that drivers are not rushed or hurried in identifying the flagging operation.

Are flaggers free of personal radios or other distractions?

Is the flagger standing alone?

Are flaggers certified if required?

Are flaggers equipped with any special equipment required in the contract (cones, flashlights, protective clothing, etc.)?

Inspector should check on the following:

- Flaggers should not have a walkman-type radio or other distraction.
- Flaggers should be standing alone in the road, not congregating in groups, which places more workers at risk and increases flagger distractions.
- Flaggers may be required to:
 - Be certified, and
 - Have cones, flashlight, protective clothing, etc.

Are flaggers using proper flagging etiquette and conducting themselves appropriately to send a clear, respectful message to passing drivers? Are flaggers relieved regularly?

In addition to checking the flagging equipment, the flaggers themselves should be observed over a period of time to ensure they are:

- Conscientious about public and fellow worker safety.
- Correctly trained for flagging duties.
- Neat in appearance.
- Sharp in hearing and vision.
- Able to communicate with drivers.

Watch the work zone to ensure that flaggers are relieved every 1-1/2 to 2 hours. Flaggers who are on duty longer than 2 hours are likely to make mistakes making both highway agencies and contractors vulnerable to tort claims. Are flaggers using the proper techniques to signal messages to traffic?

Check that flaggers are using the proper techniques to signal messages to traffic. Three basic messages are sent by a flagger: one informing traffic to stop, another telling traffic to proceed, and one more to alert traffic to work zone conditions and to slow down accordingly. Figure 4-1, adapted from Figure VI-4 in Part VI of the MUTCD, illustrates the proper techniques for sending these three messages using both the flag and the Stop/Slow Paddle.

Finally, inspections of flagging should include determination of whether the General and/or Special Provisions apply to the flagger(s) and/or the flagging operation.

Are proper advance warning signs in place? Are "Flagger Ahead" signs removed when not needed?

Check to ensure that the proper warning signs are used according to the TCP, and that any "FLAGGER AHEAD" signs, or other signs indicating the presence of a flagger, are removed or covered when the flagger is not present.

On single-lane, two-way, flagger-controlled work zones, is there a safe means of communication for the flaggers so that traffic control may be properly coordinated?

Communication between flaggers on work sites employing more than one flagger can be crucial. In particular, an operation involving two flaggers at opposite ends of a one-lane, two-way section must coordinate traffic control by one of the following means of communication:

- Hand signals which drivers cannot confuse with flagging signals.
- Two-way radios.
- Field telephones.

Are all flaggers properly attired and equipped with approved vests and hard hats?

Protective, reflective garments make flaggers more visible and protect them from injury. For daytime work, flaggers are required to wear a flagger's vest, shirt,

or jacket that is orange, yellow, strong yellow-green, or fluorescent versions of these colors. For nighttime work, similar garments are required, but they must be retroreflective, containing retroreflective elements that are orange, yellow, white, silver, strong yellow-green, or a fluorescent version of these colors. While driving through the work zone at night, observe the flagger's garments to ensure that their design clearly identifies the flagger as a person, not some other object or traffic control device, and that the flagger's reflective clothing is visible from a distance of at least 300 meters (1000 feet). The clothing worn should make the flagger's full range of body motions clearly evident to passing motorists.

Are all flags, paddles, vests, hard hats, communication and other flagging equipment in good working condition?

Like all other work zone equipment and devices, the quality of flagging equipment must be inspected. Flaggers are the work crew's "public interface," and their flags, paddles, vests and hard hats should be in reasonably good condition for aesthetic, as well as safety and visibility reasons. Properly operating communications equipment is also vital to an efficiently-run flagging operation.

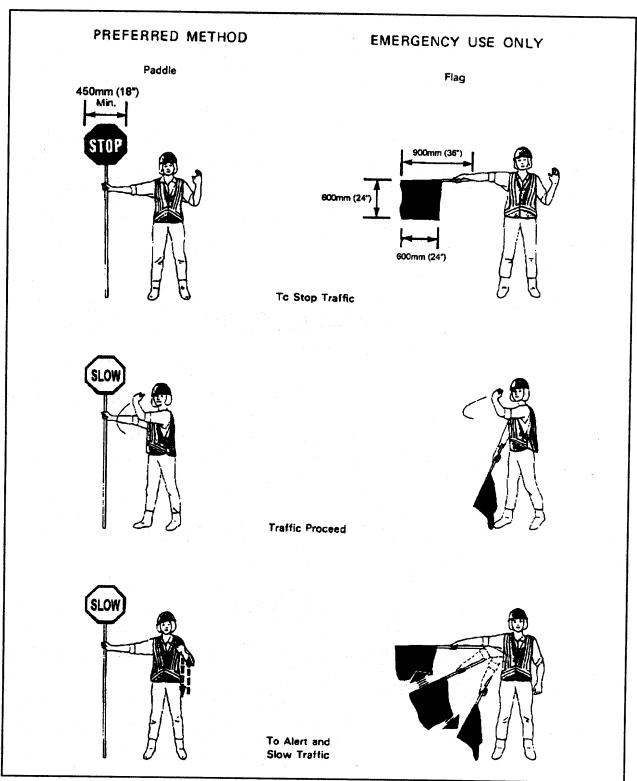


Figure 4-1. Use of hand signaling devices by flagger.

INSPECTION CHECKLIST -- Flagger/Devices

Loc	ation of Device:		
	Mile Post and Roadway or Job Number		
Any	questions answered NO should be discussed with supervisor.	YES	NC
1.	Is the flagger located properly as shown in the TCP?		
2.	Is the flagging equipment used of the proper size and color as shown in the TCP?		
3.	Do flagging paddles used meet the requirements of the MUTCD?		
4.	Is the flagger location visible to oncoming traffic at a sufficient distance to allow drivers time to respond to flagger's signal?		-
5.	Are flaggers free of personal radios or other distractions?		
6,	Is the flagger standing alone?	-	-
7.	Are flaggers certified if required?	- 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1	
8.	Are flaggers equipped with any special equipment called for in the contract (cones, flashlights, protective clothing, etc.)?		
9.	Are flaggers using proper flagging etiquette and conducting themselves appropriately to send a clear, respectful message to passing drivers?		
10.	Are flaggers relieved regularly?		
11.	Are flaggers using the proper techniques to signal messages to traffic?		
12.	Are proper advance warning signs in place?		-
13.	Are "Flagger Ahead" signs removed when not needed?		
14.	On single-lane, two-way, flagger-controlled work zones, is there a safe means of communication for the flaggers so that traffic control may be properly coordinated?		
15.	Are all flaggers properly attired and equipped with approved vests and hard hats?		***************************************
16.	Are all flags, paddles, vests, hard hats, communication and other flagging equipment in good working condition?		
	For questions answered NO, state the question number and problem:		
	State the action resulting from questions answered NO:		
			

Module V.A Construction Zone Warning Signs

INSTRUCTION SUMMARY

Duration:

10 minutes

Objective:

To familiarize participants with the basic inspection techniques for construction zone

warning signs

Content:

Types of Signs, Safety Considerations, Sign Quality, Location and Placement,

Ballasting, Sign Faces, Sign Covering and Removal, and Sign Spacing.

Equipment:

Overhead Projector

Aids:

10 Overheads

PRESENTATION OPTIONS

The participant's notebook information was developed from the information in the new Part VI of the MUTCD, along with standards for device quality obtained from ATSSA literature. Some agencies may publish specific duties of inspectors that can be substituted. If nothing specific to the agency is available, question participants about how their agency is different. If discrepancies exist between a specific agency's policy and the standards from the MUTCD, this should be acknowledged with an additional admonition that most agencies will eventually adopt the new Manual.

LESSON PLAN

Introduction

 Construction Zone Warning Signs are covered in Section V.A. of the Participant's Notebook

OV5A-1 - CONSTRUCTION ZONE SIGNS

- Construction zone signs are normally warning signs.
- These are usually small signs, which are defined as less than 4.5 square meters (50 square feet) in area.
- Signs are one of the most common devices on the road, and as a result, they get hit quite frequently.
- For this reason, the safety considerations for warning signs are quite important:
 - Support,
 - Height, and
 - Lateral Placement

An important item, as with all work zone devices, is device quality.

OV5A-2 - Acceptable, Marginal, and Unacceptable Signs

- One of the first things to check is sign quality.
- Participant's Notebook outlines standards.
- Examples are shown on this overhead.

OV5A-3 - PLACEMENT

- TCP items should be checked: number, location, placement.
 - Changes require updating of the TCP.
- Sign design and materials should also be specified.
- Signs should normally be on the right side of the roadway.

OV5A-4 - SIGN MOUNTING

- TCP may contain details for the method of sign mounting.
- On Type III Barricades, the MUTCD specifies the amount of the barricade rails that signs may be allowed to cover.
- MUTCD also has requirements for mounting height, examples on next overhead.

OV5A-5 - Plan showing height specs

- The new Part VI of the Manual requires 2.1 meter (7 feet) mounting height in both urban and rural locations.
- Some States may differ before the new Manual is adopted.

OV5A-6 - COVERING AND REMOVAL

- It is vital for public credibility purposes that inapplicable signs are covered or removed; this is a serious problem for the highway industry that is rarely taken seriously.
- To be effective, the covering method must completely cover the sign and remain secure over it even during wind loadings.

OV5A-7 - Example of good sign covering techniques

This overhead shows proper methods of covering signs; the legend is completely covered, and all the methods appear secure and wind-resistant.

OV5A-8 - Example of inadequate sign covering techniques

And here are examples of the common problems encountered in the field.

OV5A-9 - SIGN FACES

- Check that all signs to be used at night in work zones have retroreflective sheeting.
- The only place where this is not necessary is for signs that have lights installed specifically to illuminate them at night. Bright roadway lighting is not sufficient to satisfy the nighttime visibility requirement.
- The sign faces should be construction zone orange. Newer fluorescent materials are sometimes used, but, unless the TCP or Engineer say otherwise, they are only acceptable for daytime-only usage.
- Finally, check that any flags or warning lights installed do not obscure the sign.

OV5A-10 - EXISTING SIGNS AND SIGN SPACING

- Work zones are often confusing to motorists.
- They have a lot of information to digest in a short period of time.
- Signs should be spaced out at minimum distances based on speed limit.
- This allows drivers ample opportunity to read and understand each construction zone sign as it is seen.
- In particular, it is important to observe the interaction between new, work zone, and existing signs to ensure they to not conflict and that they are spaced so that drivers can read and understand them.

VISUAL AIDS

OV5A-1 - CONSTRUCTION ZONE SIGNS

- Warning Signs
- Small Signs
- Safety Considerations
 - Support
 - Height
 - Lateral Placement
- Are the signs of acceptable quality?

OV5A-2 - Photos of Acceptable, Marginal and Unacceptable Signs

OV5A-3 - PLACEMENT

- Are the proper number of signs present in accordance with the TCP?
- Are the signs located properly according to the TCP?

- Exceptions or modifications to site conditions should be documented; TCP updated.
- Do the design and materials used in the sign comply with the TCP?
 - Differences should exist only when authorized by the Engineer.
 - Materials used should be substantial and durable.
- Are all signs located on the right side of the road except when otherwise specified in the TCP?

OV5A-4 - SIGN MOUNTING

- Are the signs mounted according to the TCP?
- Do signs mounted on Type III Barricades avoid covering more than 50 percent of the top two rails, or 33 percent of all three rails?
- Are all signs (except construction zone on portable, temporary supports) mounted at a height of at least 2.1 meters (7 feet)?
- Are any secondary signs mounted at least 1.8 meters (6 feet) above the roadway?

OV5A-5 - Plan showing height standards

OV5A-6 - COVERING AND REMOVAL

- Are all signs that do not apply covered or removed as necessary?
- Does the covering method completely cover the sign face, and is it stable enough to resist wind loading?

OV5A-7 - Photo of acceptable covering methods

OV5A-8 - Photo of inadequate covering methods

OV5A-9 - SIGN FACES

- Do all signs have retroreflective sheeting?
- If not, do all signs have separate illumination that provides for night visibility?
- Are sign faces construction zone orange as specified in the TCP?
 - Fluorescent colors acceptable for daytime-only usage.
- Are flags and/or warning lights placed to prevent blockage of the sign face?

OV5A-10 - EXISTING SIGNS AND SIGN SPACING

- Do existing signs on the job site conform to the requirements of the MUTCD and the TCP?
- Do signs called for in the TCP avoid producing significant conflicts with existing signs on the job site?
- Are signs spaced correctly according to the TCP, and do the spacings allow enough time for motorists to absorb the information the signs are intended to convey?

Module V.A. Signs

Participant's Notebook Text

Visual Aids

Temporary traffic control zone signs convey specific messages by means of words or symbols and have the same three categories as all traffic signs: regulatory, warning, and guide signs.

OV5A-1 Construction Zone Signs

The emphasis of this module is on regulatory and warning signs. Signs used in temporary traffic control zones are moved frequently, loaded and unloaded from trucks, and generally receive much harsher treatment than permanent signs. For this reason, particular attention must be given to ensuring that signs are properly maintained for cleanliness, visibility, and correct positioning. Signs that are excessively worn, scratched, bent, or have lost a significant amount of retroreflectivity should be promptly replaced. Some examples of typical work zone warning signs are shown in figure 5A-1.

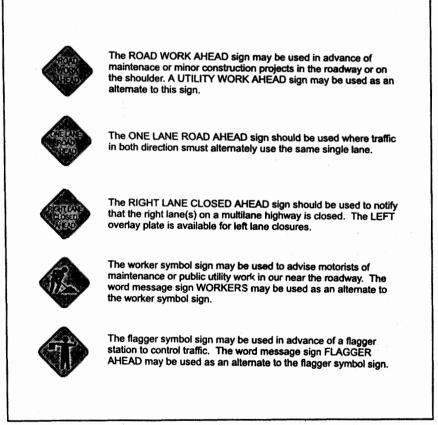


Figure 5A-1. Typical work zone warning signs.

Are the signs of acceptable quality?

OV5A-2 Acceptable, Marginal, and Unacceptable Signs

Depending on the specifications for your project, a certain number or percentage of signs may be required to be in acceptable, or at least marginal condition. The following is a brief guide to the various levels of quality for signs:

- Acceptable A sign need not be new to be acceptable. There can be several abrasions on the surface but very little loss of lettering. There has been no touch-up of the lettering. The message is legible at a minimum distance of 120 meters (400 feet) during the day and 105 meters (350 feet) with low beam headlights at night.
- Marginal A sign with marginal acceptability may have many surface abrasions throughout the sign face. Several of these are even within the individual letters of the message. The sign surface should be free of any residue. Although some color fading is acceptable, the background color and reflectivity should still be readily apparent at night. This sign's message must be legible at a minimum distance of 120 meters (400 feet) during the day and 90 meters (300 feet) with low beam headlights at night.
- Unacceptable An example of an unacceptable sign might have asphalt splatter or cement slurry covering large portions of its face. Abrasions that are extensive and spread throughout the face of a sign are unacceptable. Letters should not have losses of more than 50 percent. Significant color fading is another criteria for unacceptability.

Are the proper number of signs present in accordance with the TCP? Are the signs located properly according to the TCP? Do the design and materials used in the sign comply with the TCP?

All traffic signs should be installed at the locations and spacing specified in the traffic control plan. Any exceptions or modifications due to site conditions should be approved, documented, and the TCP should be updated to reflect the changes.

Designs or materials used should differ from the TCP only when authorized by the Engineer. Check the TCP to ensure the required designs and materials are used before registering a problem. All materials used in construction zone signs shall be substantial and durable.

Are all signs located on the right-hand side of the road except in cases where the TCP specifies otherwise?

OV5A-3 Placement

Check to ensure that most signs are located on the right-hand side of the roadway. Where special emphasis is needed, signs may be placed on both the left and right sides of the roadway. Check the TCP to ensure that sign placement is in compliance.

Are the signs mounted according to the TCP? Do signs mounted on Type III barricades avoid covering more than 50 percent of the top two rails or 33 percent of all three rails?

OV5A-4 Sign Mounting

Signs may be mounted on portable supports placed within the roadway itself. Signs, although ordinarily mounted on posts, may also be mounted on or above barricades. If mounted on Type III barricades, the sign shall not cover over 50 percent of the top two rails or 33 percent of the top three rails.

Are all signs (except construction zone signs on portable, temporary supports) mounted at a height of at least 2.1 meters (7 feet)?

Is the bottom of any secondary signs at least 1.8 meters (6 feet) off the road surface?

OV5A-5 Plan showing height specs

Normally, the MUTCD specifies heights for post-mounted and other signs in work zones. However, in construction zones, signs may be mounted on portable supports at a lower height off of the pavement for temporary conditions. Unprotected sign systems should be crashworthy. The bottom of signs mounted on barricades, or temporary supports, shall be no less than 1 foot above the traveled way. Figure 5A-2 illustrates proper mounting techniques for work zone signs. Check to ensure that signs used in this manner do not remain on the work site for long periods of time.

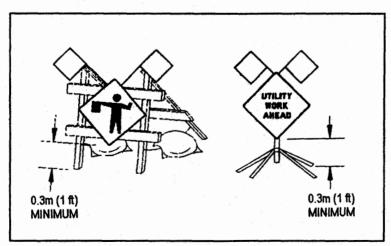


Figure 5A-2. Work zone sign mounting height.

Signs in work zones that remain in place for longer periods of time must be mounted at a height of at least 2.1 meters (7 feet), measured from the bottom of the sign to the near edge of the pavement. The height to the bottom of a secondary sign mounted below another sign may be 0.3 meters (1 foot) less than the appropriate height specified above.

Are all signs that do not apply covered or removed as necessary? Is the covering method such that the sign face is completely covered, and is it stable enough to resist wind loadings?

OV5A-6 Covering and Removal

Check to ensure that there are no unnecessary or nonapplicable signs and devices evident at the work site. These signs should be covered or removed as soon as practicable to encourage driver respect for and confidence in the project's traffic control plan. The covering method chosen should cover the sign completely and securely.

Sign covering and removal is a topic of critical importance in the inspection and maintenance of work zone safety. The problem is endemic among the highway community and causes highway agencies to lose a great deal of credibility with roadway users. It is vital to ensure that signs are not just covered at the end of the day (though often even this is not done), but also to ensure that the covering method is secure enough that the covers will still be on the signs the next morning, or longer, as necessary. The covering method must remain secure during high winds and other climatic conditions. Also, coverings such as burlap sacks, which will allow signs to retroreflect through their surface and become legible at night, are unacceptable. Failing installation of proper coverings, signs with incorrect or misleading legends should be removed from the job site.

OV5A-7 Example of good sign covering techniques

OV5A-8 Example of inadequate sign covering techniques

Figures 5A-3 and 5A-4, respectively, illustrate improper and proper methods of sign covering and removal.

Are all signs that are to be visible at night coated with retroreflective sheeting? If not, does the sign have separate illumination, internal or external, that provides for sufficient night visibility?

OV5A-9 Sign Faces

Are sign faces construction zone orange as specified in the TCP?

Check that the sign faces of all signs to be used at night are made with retroreflective sheeting. The only case where signs used at night do not have to be retroreflective is when separate illumination, internal or external, provides sufficient lighting for night visibility. Roadway or street lighting is not adequate to illuminate construction zone signs. Where the color orange is specified for temporary traffic control zones, fluorescent red-orange or fluorescent yellow-orange colors may be used.

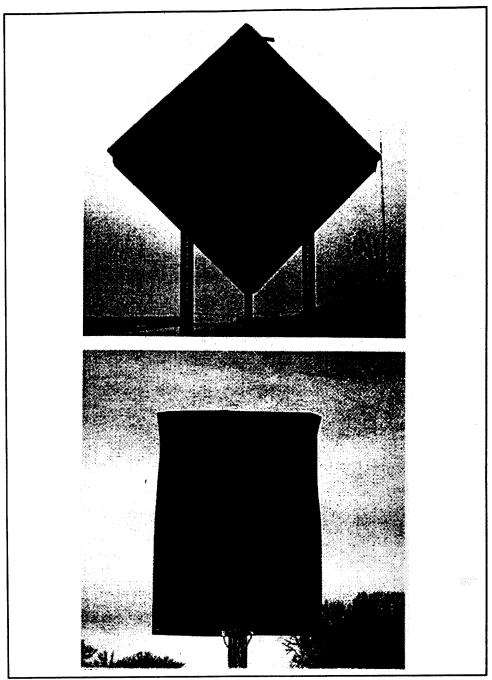


Figure 5A-3. Acceptable methods of sign covering.

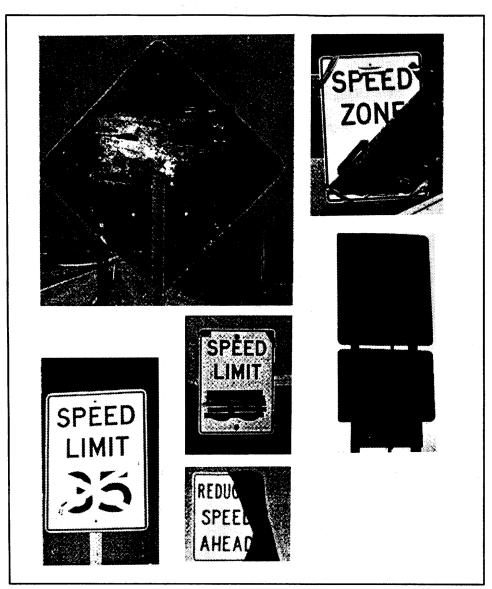


Figure 5A-4. Unacceptable methods of sign covering.

Are any flags or warning lights used placed in such a way as to prevent the possibility of blockage of the sign face?

Standard orange flags or yellow flashing warning lights may be used in conjunction with signs. However, they must not block the sign face.

Do existing signs on the job site conform to the requirements of the MUTCD and the TCP?

OV5A-10 Existing Signs and Sign Spacing

Generally, the plans will specify the specific signs to be used. Many of these signs are standard signs consistent with the size, color, shape, and message in Part VI of the MUTCD. Check that other Standard signs such as regulatory signs are consistent with standards in other parts of the MUTCD for color, shape, and message. Standard signs can vary in size and those used should be consistent with the size identified in the TCP; however, they may be larger than is specified in the MUTCD.

Existing signs are also part of the traffic control. Sometimes, the contract will require removal or covering of these signs. When it does, the inspector should verify that this is being, or has been, done. Existing signs that remain in use and are essential to the TCP should also be reviewed. Existing signs that are sub-standard (in terms of device quality) should be brought to the attention of the project engineer.

Do signs called for in the TCP avoid producing significant conflicts with existing signs on the job site?

Check sign location for conflicts with existing signs. Often, standard traffic control device layouts are applied without a site review. Consequently, signs may conflict. For example, the traffic control plan may require a STOP sign without removing or covering an existing YIELD sign; the TCP might call for a speed limit sign (with a lower speed limit) to be placed between existing speed limit signs. Conflicts such as these should be brought to the attention of the project engineer.

Are signs spaced correctly according to the TCP, and do the spacings allow enough time for motorists to absorb the information the sign is intended to convey?

In construction zones, drivers are often inundated with a wealth of information about surrounding conditions. This can lead to driver information overload, a particularly dangerous condition in work zones, where rapidly-changing conditions can require quick reactions and judgements on the part of motorists. To reduce this effect, it is helpful to ensure that a minimum spacing between signs is maintained in order to allow motorists to process the information from one sign before being faced with another. It is important to ensure the combination of work zone signs and existing signs does not overload drivers. Minimum sign spacing

is based on the time required by motorists to read and understand a sign. Accordingly, the spacing is proportional to the speed at which motorists drive through the work zone. Drive through the work zone at the posted speed limit and try to read the various work zone, information, and other existing signs to see if there is a chance of driver information overload.

In general, spacing should be checked to ensure that it complies with the TCP, but the project engineer should be notified if it appears likely that signs are placed too closely for drivers to easily read and understand them.

INSPECTION CHECKLIST -- Signs

Date Inspected:/ _ Inspector:				
Loc	Mile Post and Roadway or Job Number			
An	y questions answered NO should be discussed with supervisor.	YES N		
1.	Are the signs of acceptable quality?			
2.	Are the proper number of signs present in accordance with the TCP?	:		
3.	Are the signs located properly according to the TCP?			
4.	Do the design and materials used in the sign comply with the TCP?			
5.	Are all signs located on the right-hand side of the road except in cases where the TCP specifies otherwise?			
6.	Are the signs mounted according to the TCP?			
7.	Do signs mounted on Type III barricades avoid covering more than 50 percent of the top two rails or 33 percent of all three rails?			
8.	Are all signs (except construction zone signs on portable, temporary supports) mounted at a height of at least 2.1 meters (7 feet)?	***************************************		
9.	Are any secondary signs mounted at least 1.8 meters (6 feet) above the roadway?			
10.	Are all signs that do not apply covered or removed as necessary?			
11.	Is the covering method such that the sign face is completely covered, and stable enough to resist wind loadings?	April 1990 and 1990 a		
12.	Are all signs that are to be visible at night coated with retroreflective sheeting? (Refer to the Retroreflective Sheeting Checklist for further information.)			
13.	If Question 12 was answered NO, does the sign have separate illumination, internal or external, that provides for sufficient night visibility?			
14.	Are sign faces construction zone orange as specified in the TCP?			
15.	Are any flags or warning lights used placed in such a way as to prevent the possibility of blockage of the sign face?			
16.	Do existing signs on the job site conform to the requirements of the MUTCD and the TCP?			
17.	Do signs called for in the TCP avoid producing significant conflicts with existing signs on the job site?			
18.	Are signs spaced correctly according to the TCP, and do the spacings allow enough time for motorists to absorb the information the sign is intended to convey?	-		
	For questions answered NO, state the question number and problem:			
· .	State the action resulting from questions answered NO:			
	State the action resulting from questions answered IVO.			
Tin	ne and date that the problem was resolved:			
	mature and Title:			

Module V.B. Sign Supports

INSTRUCTION SUMMARY

Duration:

10 minutes

Objective:

To familiarize participants with the types of and inspection techniques for

construction zone sign supports

Content:

Portable and Non-Portable Sign Supports, Wooden Supports (Sizes and Numbers),

Steel Splice Supports, Portable Supports (Day and Night)

Equipment:

Overhead Projector

Aids:

9 Overheads

PRESENTATION OPTIONS

The participant's notebook information was developed from information in the new Part VI of the MUTCD, the Roadside Design Guide, along with material from the Texas DOT's "Inspector's Training Manual." Some agencies may publish specific duties of inspectors that can be substituted. If nothing specific to the agency is available, question participants about how their agency is different. Standards for device quality were obtained from ATSSA literature. If discrepancies exist between a specific agency's policy and the standards from the MUTCD, this should be acknowledged with an additional admonition that most agencies will eventually adopt the new Manual.

LESSON PLAN

Introduction

- Sign supports are covered in Section V.B. of the Participant's Notebook.
- Overhead items are questions shown in module and on checklist at end of module.

OV5B-1 - SIGN SUPPORTS

- Simple sign supports for construction zones are of two basic types: portable and non-portable.
- Of the types of non-portable supports, we will talk only about wooden post supports and simple steel splice supports.

OV5B-2 - WOODEN SIGN SUPPORTS

- 4x4s and 4x6s
 - 4x6s must be drilled for shear
- Sign size and Number of Posts
 - Signs < 0.9 square meters (10 square feet)
 - One 4x4
 - Signs 0.9 1.9 square meters (10-21 square feet)
 - Two 4x4s OR
 - One 4x6
 - Signs > 1.9 square meters (21 square feet)
 - Three 4x4s OR
 - Two 4x6s

OV5B-3 - Plan showing typical method of drilling 4x6 for shear

- This shows how a 4x6 may be drilled for shear to improve its impact performance; 4x6 posts may present too stiff an obstacle otherwise.

OV5B-4 - SIGN SUPPORTS (continued)

- Bolts or screws must be used to attach sign faces to wooden sign supports.
- Nails have a tendency to pull through the sign face, allowing it to fly free during impact.
- Many agencies also require that washers be used under the bolt or screw head for additional protection against the sign face flying free.
- Check your agency's policy; however, the use of washers is always recommended.
- The supports must be free of external bracing, as this bracing may be hazardous during impact or may make the sign too stiff during impact, causing additional damage to the errant vehicle or its occupants.
- The stub height of a two-part sign posts is required to be less than 100 millimeters (4 inches) so that cars may pass easily over the stub after the upper support has broken away. Stub heights higher than 100 millimeters (4 inches) have a tendency to snag the impacting vehicle.

OV5B-5 - Plan showing closeup of splice detail

- This shows how the steel splice is implemented.
- Note that the maximum stub height is 100 millimeters (4 inches) from the surrounding ground surface.

OV5B-6 - Actual photo of steel splice installed in the field

- This shows a field installation of the steel splice system.

OV5B-7 - PORTABLE SIGN SUPPORTS

- Portable sign supports are often put up and taken down quickly. Often little thought is given to their configuration. It is important that they are safe and crashworthy, however.
- Check for signs of dangerous impact performance: heavy items mounted too high on the support, items that might break free in an impact, etc.
- The signs must be at least one foot off of the ground surface according to the new Part VI of the MUTCD; some States may differ in this requirement.

OV5B-8 - Plan showing typical portable sign mounting

- This shows how portable signs may be mounted.
- A wide variety of portable sign mounting configurations exist.
- Some general rules apply.
- The TCP should be checked for compliance.

VISUAL AIDS

OV5B-1 - SIGN SUPPORTS

- Non-Portable
 - Wooden
 - Steel Splice
- Portable

OV5B-2 - WOODEN SIGN SUPPORTS

- Are the wooden sign supports the proper size?
 - Signs < 0.9 square meters (10 square feet)
 - One 4x4
 - Signs 0.9 1.9 square meters (10-21 square feet)
 - Two 4x4s OR
 - One 4x6

- Signs > 1.9 square meters (21 square feet)
 - Three 4x4s OR
 - Two 4x6s
- Are 4x6 wooden posts drilled for shear to make them breakaway?
- Is the spacing on multiple-post supports at least 1.5 meters (5 feet)?

OV5B-3 - Plan showing typical method of drilling 4x6 for shear

OV5B-4 - SIGN SUPPORTS (continued)

- Are the signs attached to wooden supports with bolts or screws?
 - Nails not allowed; may pull through, allowing sign face to become projectile.
- Are the supports free of external bracing?
 - May be hazardous during impact.
- Is the stub height of a two-part post 100 mm or less?

OV5B-5 - Plan showing closeup of splice detail

OV5B-6 - Actual photo of steel splice installed in the field

OV5B-7 - PORTABLE SIGN SUPPORTS

- Are portable sign supports crashworthy?
 - Look for signs of dangerous or unacceptable impact performance.
- Are all signs mounted on portable sign supports at least 0.3 meters (1 foot) above the roadway?

OV5B-8 - Plan showing typical portable sign mounting

OV5B-9 - BALLASTING

- Are only sandbags used as ballast for sign supports?
- Are the sandbags placed as near to the ground as practical?

Module V.B. Sign Supports

Participant's Notebook Text INTRODUCTION

Visual Aids

Although not perceived as particularly hazardous, small signs can cause significant damage to impacting automobiles. Small sign supports are typically either driven directly into the soil or set in drilled holes. This module describes the basic characteristics and techniques for inspecting most commonly used small sign support hardware.

OV5B-1 Sign Supports

Are the wooden sign supports the proper size?

Wooden support posts are one of the most commonly used sign supports. General guidelines can be used to inspect wooden support posts based on the size of the sign they are supporting. In general, for signs up to 0.9 square meters (10 square feet), a single 4x4 post can be used. For signs 0.9 to 1.9 square meters (10 to 21 square feet), two 4x4's, or one 4x6, is acceptable. For signs over 1.9 square meters (21 square feet), three 4x4's must be used, or two 4x6's.

OV5B-2 Wooden Sign Supports

OV5B-3 Plan showing typical method of drilling 4x6 for shear

Are 4x6 wooden posts drilled for shear to make them breakaway? Is the spacing between posts on multiple-post sign supports at least 1.5 meters (5 feet)?

Are the signs attached to wooden supports with bolts or screws?

In order to ensure proper performance in the event of an impact, all 4x6 posts should be drilled to ensure they break away at the weakened point. See Figure 5B-1. Spacing between the posts on signs with multiple posts should be at least 1.5 meters (5 feet).

Check to ensure that signs attached to wooden sign support posts are attached with bolts or screws. Nails are not allowed. Also, many agencies require that washers are used, as well. Regardless of your agency's requirements, use of washers is highly recommended.

OV5B-4 Sign Supports (continued)

Are supports free of external bracing? Is the stub height of a two-part post 100 millimeters (4 inches) or less?

Check to ensure that all sign supports are free of external bracing that could make them too stiff in the event of an impact. Finally, perform a walk-up inspection of all two-part sign posts. Make sure that the height of the stub (the lower of the two parts, protruding from the ground) is 100 millimeters (4 inches) or less above the

OV5B-5 Plan showing closeup of splice detail

OV5B-6 Actual photo of steel splice installed

ground level.

in the field

Are portable sign supports crashworthy? Are all signs mounted on portable supports at least 0.3 meters (1 foot) above the roadway?

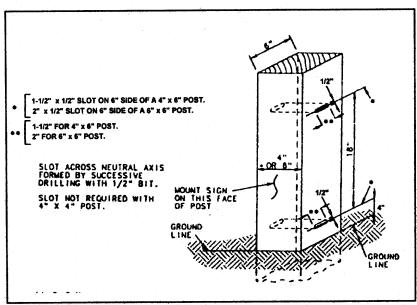


Figure 5B-1. Drilling wooden sign support posts for shear.

Portable sign supports should not present a hazard for impacting vehicles. Look for sandbags that are mounted too high, heavy items that might break free of the portable support and become projectiles in an accident, as signs of unacceptable supports. Typically, acceptable types of portable sign supports will be shown in the TCP or in each highway agency's standards or specifications. Refer to these if a portable support appears to be hazardous.

OV5B-7 Portable Sign Supports

Also, portable sign supports should maintain a minimum height of 0.3 meters (1 foot) above the roadway for the supported sign. Note this should be measured from the level of the road where the traffic flows, not 0.3 meters (1 foot) above the roadside or ditch where the sign might be mounted.

OV5B-8 Plan showing typical portable sign mounting

Are only sandbags used as ballast for sign supports? Are the sandbags placed as near to the ground as practical?

Concrete, stone, or brick used to weight signs is unacceptable. All weights used to stabilize signs other than sandbags must be rigidly attached to the sign

OV5B-9 Ballasting

Module VI. Portable Changeable Message Signs

Participant's Notebook Text INTRODUCTION

Visual Aids

A portable changeable message sign (PCMS) is an electronic sign with one to three alphanumeric lines that display messages to warn or instruct drivers. An example of a typical PCMS is shown in Figure 6-1.

OV6-1 Portable Changeable Message Signs

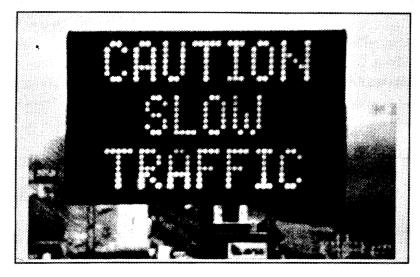


Figure 6-1. PCMS configuration.

Changeable message signs are attention-getting devices. They most frequently serve as warning and guidance in work zones on urban freeways, especially at night. One advantage they provide is the capability to provide motorists with real-time information.

Is the device located properly according to the TCP?

Do the messages displayed by the PCMS comply with those specified by the TCP or the project engineer?

OV6-2 TCP Compliance

Check to determine if the PCMS installations agree with the specifications of the TCP. Review the TCP to determine PCMS requirements. Check to ensure that the devices installed in the field comply with the TCP concerning: number of PCMSs used, location(s) for installation, messages displayed, and duration of use.

OV6-3 Picture of PCMS

Are PCMS messages accurate?

Are all letters displayed on the PCMS at least 450 millimeters (18 inches) tall?

OV6-4 PCMS Messages



Are all abbreviations used in PCMS messages clear and easily understood? Are there no more than two PCMS messages in each message cycle?

Several items concerning the messages displayed by PCMSs should be checked. Messages displayed should be accurate and up-to-date, reflecting current work zone conditions. Otherwise, motorists' respect for the traffic control plan can be serverely compromised. The letters comprising the message should be at least 450 millimeters (18 inches) high to ensure adequate visibility. Abbreviations are often used in PCMS messages. This can be beneficial, as it allows the message lengths to be shortened, decreasing the processing time required for drivers to read the message. However, inspectors must check to ensure that the abbreviations used are clear and do not have the potential to confuse drivers if they are misinterpreted. Finally, no more than two displays should be used in a single message cycle to minimize the amount of time drivers are distracted.

OV6-5 Photo of "SPEED LIMIT" PCMS Message

OV6-6 Photo of "SPEED LIMIT" PCMS Message

Is the device of acceptable quality? Are 90 percent or greater of the pixels operating properly in every individual character module?

OV6-7 PCMS Device Quality

Generally accepted minimums are given below for acceptable, marginal, and unacceptable standards for PCMSs.

- Acceptable: More than 90 percent of the pixels per character module are operating properly.
- Marginal: 90 percent of the pixels per character module are operating properly.
- Unacceptable: Less than 90 percent of the pixels per character module are operating properly or not performing within the criteria of the MUTCD.

Note: Pixels are defined as the smallest changeable element in a rectangular array that makes up the display of each letter. Each character is created by turning each pixel in the rectangular array "on" or "off" in a predetermined pattern to represent that character. Any pixel which is out of alignment will be considered "not functioning." See Figure 6-2.

Are the messages displayed short enough that they can be easily read twice while driving past the sign at the posted speed limit?

Several items on a PCMS must be inspected by driving past the device. First,

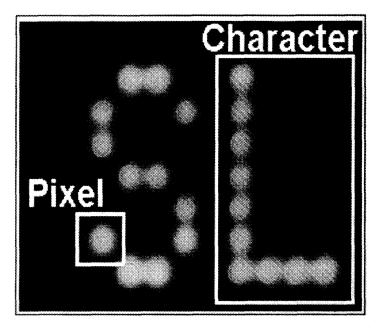


Figure 6-2. Devinition of characters/pixels.

drive past the device at the posted speed limit to simulate a worst-case condition for passing motorists. Observe the PCMS to ensure that the messages are short enough to be comfortably read by a passing driver. In fact, PCMS messages should be short enough to read the entire message twice before passing the PCMS while driving at the posted speed limit.

Is PCMS visible from a distance of at least 0.8 kilometers (0.5 miles)? Are PCMS messages easily read from all approaching traffic lanes at a distance of at least 190 meters (650 feet)?

The PCMS messages should be legible from all lanes from a distance of at least 190 meters (650 feet). The PCMS itself should be visible to motorists from a distance of at least 0.8 kilometers (0.5 miles), both during the day and at night.

OV6-8 Drive-by Inspection

Are all PCMSs located on one side of the roadway only?

Check to ensure that PCMSs are deployed on one side of the road only and that only one PCMS is visible to the driver at any given time.

Are drivers able to see only one PCMS at a time?

Two PCMSs should not be visible to the driver at any one time. The PCMS device often contains a lot of information for the driver to absorb, which is in addition to the multitude of sensory input and stimulus typically present in a construction zone situation. Two PCMSs can simply contain too much information for the driver to absorb in addition to performance of other driving tasks. This can create driver information overload, resulting in a potential degradation of driver performance. This is unsafe for motorists, pedestrians, and highway workers.

Are PCMSs moved or are their messages changed every 1 to 2 weeks?

OV6-9 Drive-by Inspection (concluded)

Because PCMSs are intended to get drivers' attention and make them immediately aware of work zone conditions, PCMSs are considered less effective if they remain in use for more than 1 to 2 weeks. In practice, it is difficult to remove or replace PCMSs this often. However, messages used on the PCMS should be changed every 1 to 2 weeks.

Are all PCMS lamps dimmed sufficiently at night to avoid glare problems for drivers?

Some PCMSs employ light bulbs arranged in a matrix as the pixel elements to make up the alphanumeric display. These types of PCMSs should be inspected to ensure that they employ a dimming mechanism at night to prevent unnecessary glare.

Is the bottom of the PCMS mounted at least 2.1 meters (7 feet) above the surface of the roadway?

Is the device aligned so that messages are easily readable to drivers?

OV6-10 Location and Placement

The bottom of the PCMS must be mounted at least 2.1 meters (7 feet) above the roadway surface to ensure adequate visibility. Also, the device should be aligned in such a way that the messages are easily readable by drivers.

INSPECTION CHECKLIST -- Portable Changeable Message Signs

Date Inspected:/ / Inspector:				
Loca	ation of Device:	Mile Post and Roadway or Job Number	· ·	
Any	questions answered	NO should be discussed with supervisor.	YES	NO
1.	Is the device locate	ed properly according to the TCP?		
2.		isplayed by the PCMS comply with those		
_		CP or the project engineer?		
3.	Are PCMS messag			
4.		ayed on the PCMS at least 450 millimeters		
_	(18 inches) tall?	DOMO		
5.		ns used in PCMS messages clear and		
6	easily understood?	than two DCMS massages in each massage availage	***************************************	
6.	Is the device of acc	than two PCMS messages in each message cycle?	-	
7. 8.		of the pixels operating properly in every		
ο,	individual characte			
9.		om a distance of at least 0.8 kilometers (0.5 miles)?	-	
10.		es easily read from all approaching traffic lanes		
10.		east 190 meters (650 feet)?		
11.		ated on one side of the roadway only?		*******
12.		see only one PCMS at a time?	****	
13.		or are their messages changed every		
	one to two weeks?			
14.		ps dimmed sufficiently at night to avoid glare		
	problems for drive			
15.	Is the bottom of the	PCMS mounted at least 2.1 meters (7 feet)		
	above the surface of	of the roadway?		
16.	Is the device aligne	ed so that messages are easily readable to drivers?		
•				
	For questions answ	vered NO, state the question number and problem:		
	State the action res	ulting from questions answered NO:		
Time	e and date that the n	roblem was resolved:	-	
	ature and Title:			

Module VII. Arrow Panels

INSTRUCTION SUMMARY

Duration:

15 minutes

Objective:

To describe points that should be covered when inspecting arrow panels

Content:

Modes, Panel Types, Mounting Height, Device Quality, Flash Rates, On-Time,

Dimming, Visibility Distances

Equipment:

VCR

Aids:

10-minute Videotape

PRESENTATION OPTIONS

The Arrow Panel video is taken from an FHWA videotape on arrow panels. If the video tape is unavailable or undesirable, slides or overheads could be made to cover the module content similarly.

LESSON PLAN

- Introduce Arrow Panels as Module VII of the Participant's Notebook.
- Mention that the video is a cut-up, shortened version of a FHWA video on arrow panels.
- Briefly discuss the inspection checklist at the rear of Module VII of the Notebook.

VISUAL AIDS

Video - 10 minutes

Module VII. Arrow Panels

Participant's Notebook Text INTRODUCTION

Visual Aids Videotape

A flashing arrow panel is a sign with a matrix of elements capable of either flashing or sequential displays. Arrow panels are effective in encouraging drivers to leave closed lanes promptly. They are especially effective on high-speed, high-volume roadways.

Do the arrow panels have sufficient mode selections as specified in the MUTCD Part VI?

Check that arrow panels have at least the mode selections illustrated in figure 7-1. Note in the figure that the stem-and-arrow displays show one lamp unlit at the end of the stem behind the arrow head. This is done to increase the legibility of the arrow head from a distance. Leaving this lamp unlit prevents the arrow head from taking on a circular, illegible appearance.

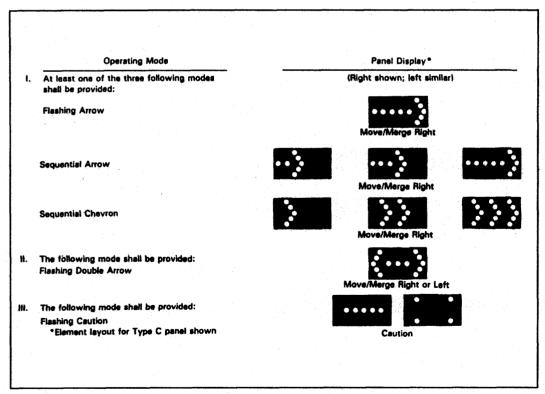


Figure 7-1. Arrow panel modes.

Do the arrow panels conform to the type specifications given in the MUTCD Part VI?

Ensure that the arrow panel conforms to one of the following type specifications:

Type A: 600x1200 millimeters (24x48 inches); should be used for low-speed urban streets, minimum of 12 elements.

Type B: 750x1500 millimeters (30x60 inches); should be used on intermediate-speed roadways, or for moving operations on high-speed roadways, minimum of 13 elements.

Type C: 1200x2400 millimeters (48x96 inches); should be used for construction operations on high-speed, high-volume roadways, minimum of 15 elements.

Are the proper number of arrow panels used according to the TCP?
Are the arrow panels located and flashing according to the TCP?
Are all arrow panels of the correct size and contain the correct number of flashing bulbs as specified in the TCP?

Several items on arrow panels installed in the field must be checked against the TCP for compliance. First, check to ensure that the proper number of arrow panels are used according to the TCP. Next, check that all such arrow panels are located properly, and flashing in the proper modes, as specified in the TCP. Finally, the arrow panels should be of the correct size and contain the correct number of flashing bulbs according to the TCP.

Are arrow panels supplemented with other appropriate traffic control devices?

An arrow panel should supplement other traffic control devices. Check to ensure that appropriate signs, barricades, or other traffic control devices are used in combination with an arrow panel.

Are the arrow panels mounted properly at least 2.1 meters (7 feet) high?

Arrow panels should be mounted at least 2.1 meters (7 feet) above the roadway if used at a stationary lane closure, or otherwise mounted in a stationary fashion on a trailer or other support. If used on a mobile or moving operation and mounted on a vehicle, the panel should be mounted as high as is practical on the back of the vehicle.

For each of the operating modes shown in figure 7-1, are all arrow panels of acceptable quality?

The following paragraphs give information on the acceptable, marginal, and unacceptable states for the arrow panel, broken down by operating mode. Note that for evaluation purposes, any operating element that is out of alignment will be considered "not functioning."

Flashing arrow or sequential arrow mode

Acceptable: Not more than one element out in the arrow stem and none out in the arrow head, and dimming properly.

Marginal:Two or less elements in arrow stem out. No elements out in the arrow head. Dimming properly.

Unacceptable: Any element out in the arrow head, or more than two elements out in the arrow stem, or arrow panel not dimming properly.

Chevron mode

Acceptable: No elements out in any chevron segment, and dimming properly.

Marginal: Not more than one element out in any one chevron segment, and dimming properly.

Unacceptable: Two or more elements out in any one chevron segment, or not dimming properly.

Caution mode (bar or corners)

Acceptable: Four or more elements operating and dimming properly.

Marginal: Minimum of four elements functioning, dimming properly.

Unacceptable: Less than four elements functioning, or not dimming properly.

Double arrow mode

Acceptable: Not more than one element out in the arrow stem, none out in the arrow head, and dimming properly.

Marginal:Two elements out in arrow stem, but both arrow head completely functional with no elements out, and dimming properly.

Unacceptable: Any elements out in either arrow head, more than two elements out in arrow stem, or not dimming properly.

Are all flash rates in the range of 25-40 flashes per minute? For flashing modes, is the minimum "on-time" at least 50 percent for every lamp?

For sequential modes, is the minimum "on-time" at least 25 percent for the last sequential phase, with earlier phases on in higher multiples of 25 percent?

Most arrow panels use incandescent lamps as the elements in the arrow panel. For these panels, check to ensure that all lamps are operating and aimed correctly. The light emitted from the lamps should be yellow in color. The flash rate for the arrow panels should be between 25 and 40 flashes per minute. Each lamp in the arrow panel should have a minimum "on time" of 50 percent for the flashing modes. For the sequential arrows, each phase should have an "on time" that is a multiple of 25 percent. In other words, the last phase of the sequential arrow should be on at least 25 percent, the second-to-last phase should be on 50 percent, and so on.

Are all arrow panels properly equipped with automatic dimming switches? Are the panels dimming properly at night?

Ensure that the automatic dimming switches are working properly and that the arrow panel does not cause glare problems for motorists.

Is only one arrow panel used per lane closed?
Is the message of all arrow panels clearly understandable?
Are the panels placed so as to avoid driver confusion near ramps, median crossovers, or intersections?

Drive past lane closure tapers to inspect them. Observe the use of arrow panels closely to ensure that only one arrow panel is used per lane closure. Also, subjectively evaluate whether any of the arrow panels on the site could cause driver confusion near ramps, median crossovers, or intersections. Ensure that the message that each arrow panel is intended to convey is perfectly clear.

Are the arrow panels aligned properly?

Are the arrow panels legible from the proper distances?

While driving by the arrow panels, check to ensure that they are aligned properly. If misaligned the arrow panel will appear dimmer than it should; it will be hard to discern the directional or other message that the panel is trying to convey. If the panel is not aligned properly, it will probably not be legible at the proper distance. Table 7-1 gives legibility distances that should be obtained for the variety of arrow panel types.

Table 7-1. Arrow panel legibility requirements by panel type.

Arrow Panel Type	Minimum Number of Elements	Minimum Legibility Distance
Α	12	0.8 kilometers (0.5 miles)
В	13	1.2 kilometers (0.75 mile)
С	15	1.6 kilometers (1 mile)

INSPECTION CHECKLIST -- Arrow Panels Date Inspected: __/_ Inspector: _____ Location of Device: Mile Post and Roadway or Job Number Any questions answered NO should be discussed with supervisor. NO Do the arrow panels have sufficient mode selections as specified in the MUTCD Part 2. Do the arrow panels conform to the type specifications given in the MUTCD Part Are the proper number of arrow panels used according to the TCP? Are the arrow panels located properly, and flashing in the proper modes, according to the TCP? 5. Are all arrow panels of the correct size and contain the correct number of flashing bulbs as specified in the TCP? Are arrow panels supplemented with other traffic control devices? 6. Are all arrow panels mounted at least 2.1 meters (7 feet) above the roadway? 7. For each operating mode, do arrow panels meet the quality criteria? Flashing arrow mode: 2 or less lamps in stem out. No lamps out in arrowhead. Panel dims properly at night. Chevron mode: Not more than 1 lamp out in any one chevron segment. Panel dims properly at night. Caution mode (bar or corners): Minimum of four lamps functioning. Panel dims properly at night. Double arrow mode: 2 lamps or less in stem out. No lamps outin either arrowhead. Panel dims properly at night. Are all flash rates in the range of 25-40 flashes per minute? 10. For flashing modes, is the minimum "on-time" at least 50 percent for every lamp? 11. For sequential modes, is the minimum "on-time" at least 25 percent for the last sequential phase, with earlier phases on in higher multiples of 25 percent? 12. Are arrow panels properly equipped with automatic dimming switches? 13. Are the panels dimming properly at night? 14. Is only one arrow panel used per lane closed? 15. Is the message of the panels clearly understandable? Are the panels placed to avoid confusion near ramps, crossovers, or intersections? 16. Are the arrow panels aligned properly? 17. Are the arrow panels legible from the proper distances? For questions answered NO, state the question number and problem: State the action resulting from questions answered NO: Time and date that the problem was resolved:

Signature and Title:

Module VIII. Channelizing Devices

INSTRUCTION SUMMARY

Duration:

15 minutes

Objective:

To familiarize participants with the various types of channelizing devices and their

respective inspection techniques.

Content:

Channelizing Devices Overview, Use of Warning Lights, Spacing, Sheeting, Cones,

Tubular Markers, Vertical Panels, Drums, Barricades, Portable Barrier and

Temporary Raised Islands

Equipment:

Overhead and Slide Projector

Aids:

4 Overheads on general aspects of channelizing devices; 20 Slides with more specific

inspection aspects of individual devices

PRESENTATION OPTIONS

This module and its submodules vary somewhat from the rest of this Instructor's Guide. The four overheads follow along with the information in the Participant's Notebook Module VIII. The presentation method then switches to slides, at which point the presentation is more free form, with general observations about inspection and specific points for individual devices noted at various places in the slide presentation.

This format was chosen because so much of the inspection techniques for the different channelizing devices is repetitive and because of the time required to go through the individual checklists for each specific device. If the agency desires a more in-depth presentation for all the channelizing devices (or even just more in-depth on one device), or if the slides are unacceptable or unavailable, word overheads similar to those for the other modules could be generated from the Participant's Notebook text. Alternately, the inspection checklists at the end of each module could be used to present each individual device's inspection points in greater detail.

The participant's notebook information was developed from the information in the new Part VI of the MUTCD, along with standards for device quality obtained from ATSSA literature. Some agencies may publish specific duties of inspectors that can be substituted. If nothing specific to the agency is available, question participants about how their agency is different. If discrepancies exist between a specific agency's policy and the standards from the MUTCD, this should be acknowledged with an additional admonition that most agencies will eventually adopt the new Manual.

LESSON PLAN

Introduction

- Channelizing devices are covered in section VIII. of the Participant's Notebook.
- This presentation covers the first submodule on general inspection and then briefly highlights the other device-specific modules.

OV8-1

- Channelizing devices serve three main functions: to warn and alert drivers to the hazards of the construction zone, to protect workers from vehicles by guiding those vehicles away from work areas, and to guide drivers and pedestrians safely on the proper path through the construction zone.
- Channelizing devices function to provide for smooth traffic flow and avoid traffic conflicts, such as hard braking or other problems.
- A good way to inspect the overall functioning of a channelizing device installation is to find a place to observe the overall traffic flow through a zone and look for any such conflicts and their underlying causes that might occur.

OV8-2

- Warning lights are sometimes used on channelizing devices.
 - If they are in a zone you are inspecting, you should check that:
 - Flashing warning lights are used only for:
 - Channelizing devices used singly, as in marking a specific, stationary hazard, such as a bad pothole on a bridge.
 - Steady-burn warning lights are used for all other applications where channelizing devices are used in series.

OV8-3

- Another item to check is device spacing.
- In the transition area, channelizing device spacing should be such that the device spacing in feet is less than the posted speed limit in miles per hour.
- In the tangent area, the device spacing in feet should be less than two times the posted speed limit in miles per hour.
- On horizontal curves, the spacing can be significantly reduced to provide additional information to drivers for navigating curves in difficult situations.
- Finally, the devices should be placed at least 0.3 to 0.6 meters (1 to 2 feet) off of the edge of the travelled lane, if at all possible.

OV8-4

- The final item to check on channelizing devices is their reflective sheeting.
- It should have a smooth, sealed surface.
- Should be clean and in good condition.
- A night inspection of the channelizing devices should be performed to determine their performance in drivers' eyes.
 - Check that they are adequately visible.
 - Ineffective devices should be cleaned or replaced.
 - Finally, look to see that the spacing and placement of the devices delineates a clear and safe path through the work zone with no areas of possible confusion for motorists.

At this time, the presentation method switches to slides. Explain to students that the class will now be looking at slides of the various devices in the field. The presentation will focus on showing the various types of channelizing devices, identifying the level of quality of installed devices, and showing examples of some common problems.

SL8-1

- Cones are probably the most commonly-used channelizing device.
- They shall be orange and at least 450 millimeters (18 inches) tall for use on roads with a posted speed limit of less than 70 kilometers per hour (45 miles per hour).
- For other roads they should be at least 700 millimeters (28 inches) tall.
- When used at night, cones shall have two white, retroreflective bands at the top of the cones.
- Check to ensure that cones are weighted if wind or traffic tends to blow them over.

SL8-2

- Cones should be checked for cleanliness and condition.
- Some abrasion, discoloration, and dirt or other residue can be tolerated, but the shape of the cone should still be evident, and any reflective sheeting should be free of large areas of grime or missing material.

SL8-3

- Tubular markers should follow the same rules as cones for device height.
- Acceptable tubular markers should be basically free of punctures, abrasions, and dirt or grime. The devices should readily respond to washing, and reflective sheeting should have little or no loss of reflectivity.

SL8-4

Marginal tubes have some dirt and/or discoloration and numerous tears and scratches, but they should be free of large areas of missing reflective material.

SL8-5

Unacceptable tubes are generally very dirty, deformed, and/or have very large areas of missing reflective material.

SL8-6

- Vertical panels shall be 200-300 millimeters (8-12 inches) wide, at least 600 millimeters (24 inches) high, and the tops of the panels shall be at least 900 millimeters off of the roadway surface.
 - The orange-and-white stripes should be reflectorized.

SL8-7

- Vertical panels shall have at least 174,000 square millimeters (270 square inches) of retroreflective material if used on freeways, expressways, or other high-speed roadways.

SL8-8

- Vertical panels are available in a variety of configurations.
- They should be checked for quality following similar rules as for cones and tubes.

SL8-9

- Should be placed back-to-back when separating traffic flow in opposite directions.
- Their stripes should be checked in this case to ensure that the they slope downward in the direction in which traffic is to pass.
- Ensure that the stripe's slope is correct from both directions.
- Any weighting of vertical panels should be accomplished with sandbags on the bases, not on the tops of the panels.

SL8-10

- Drums in the work zone shall be plastic, with at least 2 orange and 2 white retroreflective stripes.
- The retroreflective sheeting shall be high-intensity sheeting.

- They shall be about 900 millimeters tall, and at least 450 millimeters (18 inches) in diameter.
- Drums should be placed above a dropoff, not on the lower section of a dropoff.
- Drums with warning lights should have reinforcement around the mounting hole; this keeps lights from becoming projectiles in an accident.

SL8-11

- One common problem to look for is weighting drums with something other than sandbags, or other safe, loose, dry materials.
- One-piece drums should be weighted with a maximum of 23 kilograms (50 pounds) of dry sand or recycled rubber tire sidewalls.
- Two-piece drums may be weighted up to 35 additional kilograms (75 additional pounds), and should be weighted with at least 13 kilograms (30 pounds).
- Sandbags or a sand-filled base are the acceptable weighting methods.
- Here the drums have been weighted with large rocks...

SL8-12

- ...though hitting this particular drum, the rock might not be the worst of the errant vehicle's worries.
- Also, note that these are steel drums, which are not acceptable, even without the large rock weights.

SL8-13

- Finally, it is necessary to check the quality and condition of the drums.
- Rules are basically the same as for other channelizing devices; the ATSSA book contains photos and standards appropriate for inspecting drum quality.

SL8-14

- Barricades include Type I, II, and III barricades.
- Standards for these are shown in the Participant's Notebook.
- Barricades should be checked to see that they have alternating orange and white stripes with high-intensity retroreflective sheeting and slope downward in the direction to which traffic is to pass.

SL8-15

- Barricades should be inspected at night to ensure adequate nighttime visibility.

SL8-16

- Roadway access.
 - Type III barricades can be used to close a road where work vehicles or equipment are still permissible.
 - In this situation, the barricades should be moved to provide access only to authorized vehicles, or should provide only indirect openings to the closed roadway.
- Regulatory signs and warning lights.
 - Regulatory signs and warning lights are also used often.
 - Check that these are according to the TCP.
 - These should be mounted at least 1.5 meters (5 feet) off of the road surface.

SL8-17

- Device Quality.
 - Barricade quality must be checked; Participant's Notebook and ATSSA guide contain standards.
 - Similar items as for other channelizers:
 - Cleanliness
 - Sheeting
 - Color Fading
 - Ballasting
 - Sandbags should be used to weight barricades.
 - These should be placed on the barricade bases.

SL8-18

- A common problem is placing the sandbags on the barricade rails.
- This must be checked and corrected if found.
- Creates a very dangerous situation.

SL8-19

- Barricades should be constructed of lightweight materials.
- Fasteners should be bolts or lag screws; nails are not acceptable.

SL8-20

- The final channelizer is the temporary raised island.
- Standards are sparse for this device.

- Main items to check are that it conforms to the TCP, and that it is delineated properly so as to avoid driver confusion.
- A typical configuration is shown in the Participant's Notebook.

VISUAL AIDS

OV8-1 - CHANNELIZING DEVICES

- Functions
 - Warn and alert drivers.
 - Protect workers.
 - Guide drivers and pedestrians safely.
- Do the channelizing devices provide for smooth traffic flow and delineation?
 - Traffic Observation
 - Daytime
 - Nighttime

OV8-2 - WARNING LIGHTS

- Sometimes Used on Channelizing Devices
 - Are warning lights used on a series of channelizing devices steady-burn warning lights?
 - Are warning lights used individually, such as to mark a hazard, flashing warning lights?

OV8-3 - DEVICE SPACING

- Is the taper length, in feet, greater than or equal to the taper length specified in the TCP?
- In the transition area, is the device spacing (S), in feet, less than or equal to the speed limit in MPH?
- In the tangent area, is the device spacing (2xS), in feet, less than or equal to 2 times the speed limit in MPH?
- Where possible, are the channelizing devices set 0.3 to 0.6 meters (1 to 2 feet) back from the traffic lane?

OV8-4 - RETROREFLECTIVE SHEETING

- Are all channelizing devices equipped with retroreflective sheeting for night visibility?
- Does the sheeting have a smooth, sealed outer surface, and provide good night visibility?
 - Night Inspection
 - Clean or Replace Ineffective Devices
 - Appropriate Spacing for Guidance
- If other information, such as the supplier or contractor name, appears on the devices, is it only on a non-retroreflective surface?
- Is such information not over 50 millimeters (2 inches) in height?
- SL8-1 Photo of inspector measuring cone
- SL8-2 Photo of dirty cone
- SL8-3 Photo of acceptable tubular marker
- **SL8-4 Photo of marginal tubular marker**
- SL8-5 Photo of unacceptable tubular marker
- **SL8-6 Photo of vertical panel**
- **SL8-7 Second photo of vertical panel**
- SL8-8 Third photo of vertical panel
- SL8-9 Photo of vertical panel in opposing traffic situation
- SL8-10 Photo of drum with warning light
- SL8-11 Photo of overturned steel drum with large rock at base
- SL8-12 Photo of same drum showing dropoff next to drum
- SL8-13 Photo of drum

- SL8-14 Photo of barricade
- SL8-15 Night photo of barricade
- SL8-16 Photo of Type III barricade blocking off road with ROAD CLOSED sign
- SL8-17 Photo of barricade with sandbag weights at base
- SL8-18 Photo of Type II barricade with sandbags on rails
- SL8-19 Photo of barricade construction with PVC pipe
- SL8-20 Photo of temporary raised island with traffic flowing nearby

Module VIII. Channelizing Devices

Participant's Notebook Text INTRODUCTION

Visual Aids
OV8-1
Channelizing
Devices

The function of channelizing devices is to warn and alert drivers of conditions created by work activities in or near the traveled way, to protect workers in the temporary traffic control zone, and to guide drivers and pedestrians safely.

Do the channelizing devices provide smooth traffic flow during the daytime? Do the channelizing devices provide smooth traffic flow and delineation during the nighttime?

The ultimate goal of a channelizing device installation is to provide for a smooth flow of traffic through the work zone by providing guidance and alignment information for drivers. Observe the overall flow of traffic through the work zone, both during the day and at night, to ensure that traffic does indeed flow easily, without significant areas of conflict, hard braking, or other possible problems. To accomplish their purpose, the channelizing devices must perform as a system of devices. As an inspector you must look for this "system" quality in a channelizing device installation that occurs when all the devices work together to provide for smooth traffic flow.

Are warning lights used in a series steady-burn warning lights? Are warning lights used singly flashing warning lights?

OV8-2 Warning Lights

Warning lights are often used on channelizing devices to provide additional information to drivers. Check that flashing warning lights are only used on channelizing devices if they are used singly, or in groups that mark a spot condition, such as a pothole. Otherwise, check that all warning lights used on channelizing devices arranged in series are steady-burn warning lights.

Is the taper length, in feet, greater than or equal to the taper length specified in the TCP?

OV8-3 Device Spacing

In the transition area, is the device spacing (S), in feet, less than or equal to the speed limit, in mph?

In general, channelizing device spacing should be checked for compliance with the TCP. In the transition area, however, it is a good idea to check that the spacing, S, in feet, is less than or equal to the posted speed limit in miles per hour.

In the tangent area, is the device spacing (2xS), in feet, less than or equal to 2 times the speed limit in mph?

On curved roadway sections, has the spacing of channelizing devices been reduced?

Where possible, are channelizing devices set 0.3 to 0.6 meters (1 to 2 feet) back from the traffic lane?

In the tangent area, the device spacing, 2xS, in feet, should be less than or equal to two times the speed limit in miles per hour. However, in areas of the site where there is a horizontal curve, check to see that device spacing has been significantly reduced in order to provide improved alignment information for motorists. Also, check that, where possible, channelizing devices are set back 0.3 to 0.6 meters (1 to 2 feet) from the edge of the traffic lane to prevent traffic from shying too far toward the other side of the lane.

Are all channelizing devices equipped with retroreflective sheeting for night visibility?

Does the sheeting have a smooth, sealed outer surface and provide good night visibility?

for to

OV8-4

Sheeting

Retroreflective

All channelizing devices should be equipped with retroreflective sheeting for night visibility. This sheeting must have a smooth, sealed outer surface. Check to ensure that the sheeting is clean and is effective for night visibility by performing a nighttime drive-through of the work zone. Check that devices are placed properly to clearly guide drivers and not present a confusing scenario at night. Ensure that damaged or non-visible devices are cleaned or replaced, as appropriate.

If other information, such as the supplier or contractor name and telephone number, appears on the channelizing devices, does this information appear only on a non-retroreflective surface of the channelizing device? Is this information non-retroreflective and not over 50 millimeters (2 inches) in height?

Many channelizing devices have the name and telephone number of the highway agency, contractor, or supplier written or painted on them. If channelizing devices have this information, it should only appear on non-retroreflective surfaces. This information should also be non-retroreflective and not over 50 millimeters (2 inches) in height.

INSPECTION CHECKLIST -- Channelizing Devices

	ation of Device:	
Loca	Mile Post and Roadway or Job Number	
Any	questions answered NO should be discussed with supervisor.	YES
1.	Do the channelizing devices provide smooth traffic flow during the daytime?	***************************************
2.	Do the channelizing devices provide smooth traffic flow and delineation during the nighttime?	
3.	Are warning lights used in a series steady-burn warning lights?	
4.	Are warning lights used singly flashing warning lights?	
5.	Is the taper length, in feet, greater than or equal to the taper length specified in the TCP?	-
6.	In the transition area, is the device spacing (S), in feet, less than or equal to the speed limit, in mph?	-
7.	In the tangent area, is the device spacing (2xS), in feet, less than or equal to 2 times the speed limit in mph?	
8.	On curved roadway sections, has the spacing of channelizing devices been reduced?	***************************************
9.	Where possible, are channelizing devices set 0.3 to 0.6 meters (1 to 2 feet back from the traffic lane?	-
10.	Are all channelizing devices equipped with retroreflective sheeting for night visibility?	
11.	Does the sheeting have a smooth, sealed outer surface and provide good night visibility?	
12.	If other information, such as the supplier or contractor name	-
	and telephone number, appears on the channelizing devices,	
	does this information appear only on a non-retroreflective surface of the channelizing device?	
13.	Is this information non-retroreflective and not over 50 millimeters (2 inches) in height?	
	For questions answered NO, state the question number and problem:	
	State the action resulting from questions answered NO:	
Tim	e and date that the problem was resolved:	
	nature and Title:	

Module VIII.A. Cones

Participant's Notebook Text

Are cones orange in color?

If cones are used only during the daytime on low-speed roadways (< 70 kilometers per hour (45 miles per hour)), are they at least 450 millimeters (18 inches) in height?

If cones are used during the nighttime on a freeway or on a high-speed roadway (\geq 70 kilometers per hour (45 miles per hour)), are they at least 700 millimeters (28 inches) in height?

Check to ensure that cones used are orange in color. Cones used only during the daytime, and on roadways with a posted speed limit of less than 70 kilometers per hour (45 miles per hour), may be 450 millimeters (18 inches) or greater in height. However, cones used at night or on other types of roadways must be checked to ensure that they are at least 700 millimeters (28 inches) in height.

If cones are used during the nighttime, do they have two retroreflective white bands?

Is the top white band 150 millimeters (6 inches) in height, 75 to 100 millimeters (3 to 4 inches) below the top of the cone, and does it span the circumference of the cone?

Is the bottom white band spaced 50 millimeters (2 inches) below the top band, 100 millimeter (4 inches) in height, and does it span the circumference of the cone?

Cones used at night shall have two, retroreflective, white bands. The top white band should be 150 millimeters (6 inches) in height, should be 75 to 100 millimeters (3 to 4 inches) below the top of the cone, and should span the entire circumference of the cone. The second white band should be 100 millimeters (4 inches) in height, spaced 50 millimeters (2 inches) below the bottom of the top white band.

Are the cones weighted properly so that they remain in place and upright?

Cones can be weighted in any one of the following methods if wind or traffic tends to blow them over. In this case, check to ensure that the contractor has:

- Used devices with weighted bases,
- Filled bases with ballast,
- Stacked cones double, or
- Weighted bases with sandbags, rings, or other approved devices.

Visual Aids
See Module VIII.
Channelizing
Devices

Check to ensure that the weighting method used keeps cones in place and upright.

Are the individual cones in "acceptable" condition? Is the array of cones in "acceptable" condition?

The definitions of acceptable, marginal, and unacceptable cones are given below:

- Cones are acceptable if they are conical in shape and remain clearly identifiable with no significant distortion and must be free standing in its normal position. The surface should be free of punctures, abrasions, asphalt splatter, cement slurry or other material and will readily respond to washing. The reflective bands, if required, have little or no loss of reflectivity, with only minor tears and scratches.
- Cones are marginal if the surface has some asphalt splatterings or cement slurry and may not be readily cleaned due to abrasion and discoloration. The reflective bands, if required, may have numerous tears and scratches, but are free of large areas of residue or missing material.
- Cones are unacceptable if punctures and large areas of staining asphalt splatter or cement slurry make these an unlikely candidate for improvement. Large areas of missing or stained reflective material may make the cone unacceptable.

INSPECTION CHECKLIST -- Cones

	Mile Post and Roadway or Job Number		
Any	questions answered NO should be discussed with supervisor.	YES	NO
1.	Are cones orange in color?	-	
2.	If cones are used only during the daytime, or on low-speed roadways (< 70 kilometers per hour (45 miles per hour)), are they at least 450 millimeters (18 inches) in height?		
3.	If cones are used during the nighttime, on a freeway or on a high-speed roadway (≥ 70 kilometers per hour (45 miles per hour)), are they at least 700 millimeters (28 inches) in height?		
4.	If cones are used during the nighttime, do they have two retroreflective white bands?		
5.	Is the top white band 150 millimeters (6 inches) in height, 75 to 100 millimeters (3 to 4 inches) below the top of the cone, and span the circumference of the cone?		
6.	Is the bottom white band spaced 50 millimeters (2 inches) below the top band, 100 millimeters (4 inches) in height, and span the circumference of the cone?		
7.	Are the cones weighted properly so that they remain in place and upright?		
8.	Are the individual cones in "acceptable" condition?		
9.	Is the array of cones in "acceptable" condition?		
	For questions answered NO, state the question number and problem:		
	State the action resulting from questions answered NO:		

Module VIII.B. Tubular Markers

Participant's Notebook Text

Are tubular markers orange in color?

If tubular markers are used only during the daytime and on low-speed roadways (< 70 kilometers per hour (45 miles per hour)), are they at least 450 millimeters (18 inches) in height?

If tubular markers are used during the nighttime on a freeway or on a high-speed roadway (\geq 70 kilometers per hour (45 miles per hour)), are they at least 700 millimeters (28 inches) in height?

Check to ensure that tubular markers used are orange in color. Tubular markers used only during the daytime, on roadways with a posted speed limit of less than 70 kilometers per hour (45 miles per hour) may be 450 millimeters (18 inches) or greater in height. However, tubular markers used at night or on other types of roadways must be checked to ensure that they are at least 700 millimeters (28 inches) in height. Tubular markers facing traffic must be at least 50 millimeters (2 inches) wide to provide a sufficient target for motorists.

If tubular markers are used during the nighttime, do they have two retroreflective white bands?

Is the top white band 75 millimeters (3 inches) in height, 50 millimeters (2 inches) below the top of the tube, and does it span the circumference of the tube?

Is the bottom white band spaced 50 to 150 millimeters (2 to 6 inches) below the top band, 75 millimeters (3 inches) in height, and does it span the circumference of the cone?

Tubular markers used at night should have two retroreflective white bands. The top white band should be 75 millimeters (3 inches) in height, should be 50 millimeters (2 inches) below the top of the tubular marker and should span the entire circumference of the tubular marker. The second white band should then be spaced 50 to 150 millimeters (2 to 6 inches) below the bottom of the top white band and should be 75 millimeters (3 inches) in height.

If sandbags are used to deter traffic from hitting tubular markers, are they placed at the base of the tubular marker only?

Sandbags may be placed on the base to deter traffic from intentionally hitting the tubular marker.

Are the tubes in "acceptable" condition?

Visual Aids
See Module VIII.
Channelizing
Devices

Is the array of devices acceptable?

The definitions of acceptable, marginal, and unacceptable tubular markers are given below:

- Tubular markers are acceptable if the surface is free of punctures, abrasions, asphalt splatter, cement slurry or other material and will readily respond to washing. The reflective bands, if required, have little or no loss of reflectivity, with only minor tears and scratches.
- Tubular markers are **marginal** if the surface has some asphalt splatterings or cement slurry and may not be readily cleaned due to abrasion and discoloration. The reflective bands, if required, may have numerous tears and scratches, but are free of large areas of residue or missing material.
- Tubular markers are unacceptable if punctures and large areas of staining asphalt splatter or cement slurry make these an unlikely candidate for improvement. Large areas of missing or stained reflective material may make the tubular marker unacceptable.

INSPECTION CHECKLIST -- Tubular Markers

	Inspected:/ / Inspector:		
Loca	mile Post and Roadway or Job Number		· .
Any	questions answered NO should be discussed with supervisor.	YES	NC
1.	Are tubular markers orange in color?		
2.	If tubular markers are used only during the daytime or on low-speed roadways (< 70 kilometers per hour (45 miles per hour), are they at least 450 millimeters (18 inches) in height? If tubular markers are used during the nighttime on a freeway or on a high-speed roadway (≥ 70 kilometers per hour (45 miles per hour)), are they at least 700 millimeters (28 inches) in height?		
3.			
4.	If tubular markers are used during the nighttime, do they have two retroreflective white bands?		
5.	Is the top white band 75 millimeters (3 inches) in height, 50 millimeters (2 inches) below the top of the tube, and does it span the circumference of the tube?	-	
6.	Is the bottom white band spaced 50 to 150 millimeters (2 to 6 inches) below the top band, 75 millimeters (3 inches) high, and does it span the circumference of the cone?		
7.	If sandbags are used to deter traffic from hitting tubular markers, are they placed at the base of the tubular marker only?		
8.	Are the tubes in "acceptable" condition?		
9.	Is the array of devices acceptable?		
	For questions answered NO, state the question number and problem:		
	State the action resulting from questions answered NO:		
			·····
	e and date that the problem was resolved:ature and Title:		

Module VIII.C. Vertical Panels

Participant's Notebook Text

Are vertical panels 200 to 300 millimeters (8 to 12 inches) in width and at least 600 millimeters (24 inches) in height?

Are vertical panels mounted with the top at least 0.9 meters (3 feet) above the roadway?

Are they orange (fluorescent red-orange or fluorescent yellow-orange) with white stripes and retroreflectorized?

For panels less than 900 millimeters (36 inches) in height, are there four stripes?

Vertical panels should be clean and in good condition, 200 to 300 millimeters (8 to 12 inches) wide, at least 600 millimeters (24 inches) high, and at least 900 millimeters (36 inches) above the roadway (from the tops of the panels). The panels should have orange (fluorescent red-orange or fluorescent yellow-orange) and white stripes and be retroreflectorized. Panels less than 900 millimeters (36 inches) in height should have four stripes.

Are the panel stripes 150 millimeters (6 inches) wide for panel heights of 900 millimeters (36 inches), and 100 millimeters (4 inches) wide for panel heights of less than 900 millimeters (36 inches)?

Do panels used on high-speed roadways have at least 174,000 square millimeters (270 square inches) of retroreflective material on the side facing traffic?

The panel stripes should be 150 millimeters (6 inches) wide for panel heights of 900 millimeters (36 inches), and stripes should be 100 millimeters (4 inches) wide for panel heights of less than 900 millimeters (36 inches). When used on freeways, expressways, or other high-speed roadways, vertical panels shall have at least 174,000 square millimeters (270 square inches) of retroreflective material on the side facing traffic.

If used for two-way traffic, are back-to-back panels used? Do the stripes on the panels slope downward in the direction in which traffic is to pass?

Vertical panels should be placed back-to-back if they separate traffic from opposite directions. Panels with stripes that begin at the upper left and slope downward toward the lower right should only be used where traffic is intended to pass to the right of the panels. Vertical panels may be placed for traffic separation or shoulder barricading where space is at a minimum.

Is the array of vertical panels acceptable?

Visual Aids See Module VIII.

Channelizing
Devices

The definitions of acceptable, marginal, and unacceptable vertical panels are given below:

- A vertical panel is **acceptable** if it is not deformed to an extent so as to decrease the panel's target value. There may be several abrasions on the surface but very little loss of reflective sheeting. The orange is vivid and the stripes provide contrast.
- A vertical panel is **marginal** if there are numerous surface abrasions through the panel's surface or if there is fading evident. There should not be large areas of residue or missing reflective material. The orange should be vivid and the stripes provide contrast.
- A vertical panel is **unacceptable** if the surface is marred over a high percentage of the panel's area, there is noticeable loss of reflectivity, or obvious color fading. Panels with asphalt splatter and/or cement slurry, or any combination of missing and covered reflective material, would also make the panel unacceptable.

Are the base and panel supports substantial and designed to resist overturning? Is the base designed to minimize damage to vehicles if impacted by an errant vehicle?

The base and panel support shall be substantial and designed to resist overturning. It is permissible, however, for contractors to add weight to the panels. If this is necessary, it should be accomplished with sandbags on the bases, not on the tops of the panels. Because the base can be hazardous to traffic when overturned, it should be designed to minimize damage to vehicles.

INSPECTION CHECKLIST -- Vertical Panels

	e Inspected:/ / Inspector:		
Loc	Mile Post and Roadway or Job Number		
Any	y questions answered NO should be discussed with supervisor.	YES	NC
1.	Are vertical panels 200 to 300 millimeters (8 to 12 inches) in width and at least 600 millimeters (24 inches) in height?		
2.	Are vertical panels mounted with the top at least 900 millimeters (36 inches) above the roadway?		- ,
3.	Are they orange (fluorescent red-orange or fluorescent yellow-orange) with white stripes and retroreflectorized?		
4.	For panels less than 900 millimeters (36 inches) in height, are there four stripes?		
5.	Are the panel stripes 150 millimeters (6 inches) wide for panel heights of 900 millimeters (36 inches), and 100 millimeters (4 inches) wide for panel heights of less than 900 millimeters (36 inches)?		
6.	Do panels used on high-speed roadways have at least 174,000 square millimeters (270 square inches) of retroreflective material on the side facing traffic?	·	
7.	If used for two-way traffic, are back-to-back panels used?		
8.	Do the stripes on the panels slope downward in the direction in which traffic is to pass?	-	
9.	Is the array of vertical panels acceptable?		-
	Are the base and panel support substantial and designed to resist overturning? Is the base designed to minimize damage if impacted by an errant vehicle?		
	For questions answered NO, state the question number and problem:		
			
	State the action resulting from questions answered NO:		
	ne and date that the problem was resolved:nature and Title:		

Module VIII.D. Drums

Participant's Notebook Text

Are all drums plastic rather than metal?

Are the drums: orange in color, approximately 900 millimeters (36 inches) high, and at least 450 millimeters (18 inches) in diameter?

Do the retroreflectorized stripes extend around the circumferences of the drums?

Do the stripes measure 100 to 150 millimeters (4 to 6 inches) in width?

Does each drum have at least 2 orange and 2 white stripes?

Are the non-retroreflectorized spaces between stripes no more than 50 millimeters (2 inches) wide?

All drums used in work zones must be plastic rather than metal. The drums shall all be orange, approximately 900 millimeters (36 inches) tall, and at least 450 millimeters (18 inches) in diameter. The stripes on the drums should go completely around the drums and be about 100 to 150 millimeters (4 to 6 inches) in width. There should be at least two orange and two white stripes, and any non-reflectorized spaces between the stripes should be no more than 50 millimeters (2 inches) wide.

Do the drums have closed tops that will not allow collection of construction or other debris?

Are the drums free from heavy objects placed on their tops?

Check that the drums have closed tops that will prevent collection of debris inside the drums, and ensure that heavy objects have not been placed on top of the drums.

If 1-piece drums are specified, are they weighted with a maximum of 23 kilograms (50 pounds) of sand (or recycled rubber tire sidewalls)?

If 2-piece drums are specified, are they weighted with a minimum of 13 kilograms (30 pounds) and a maximum of 35 kilograms (75 pounds) of sand placed in one or two sandbags, or a sand-filled base (recycled rubber tire sidewalls may also be used)?

One-piece drums should be weighted with a maximum of 23 kilograms (50 pounds) of sand. Two-piece drums should be weighted with a minimum of 13 kilograms (30 pounds) and a maximum of 35 kilograms (75 pounds) of sand. These may be placed either in one or two sandbags or in a sand-filled base. Recycled rubber tire sidewalls are also acceptable for use as ballast.

Many drum manufacturers provide recommendations concerning drum

Visual Aids
See Module VIII.
Channelizing Devices

weighting methods. When possible, these recommendations should be the overriding rule for that manufacturer's drums.

Are the drums in acceptable condition? Is the array of drums acceptable?

The definitions of acceptable, marginal, and unacceptable drums are given below:

- Drums are **acceptable** when the sheeting has only minor tears and scratches. Dents do not seriously reduce the retroreflectivity. The drum maintains its intended original shape.
- Drums are marginal when the sheeting has numerous tears and scratches; however, it is free of large areas of residue or missing retroreflective material. Dents reduce the effectiveness of the retroreflective sheeting, but the drum strength is not reduced. The drum maintains its intended original shape.
- Drums are unacceptable when there are large areas of missing retroreflective sheeting. Drums with asphalt splatter and/or cement slurry, or any combination of missing and covered retroreflective material, can also make the drum unacceptable. Substantial deformation of a drum which reduces the original dimensions may cause the drum to be considered as unacceptable even if other parameters are still acceptable.

If drums are used at a dropoff, are the drums on top of the dropoff? If contractors secure two-piece drums to the pavement to keep them in place, are only nails or adhesives used to secure the drums?

When used to keep drivers away from a pavement edge or dropoff, ensure that the drums are placed on the top of the dropoff, not on its lower section.

If contractors secure two-piece drums to the pavement to keep them in place, inspect to ensure that workers use only nails or adhesives. However, the use of nails is discouraged.

For two-piece drums, is the height of the base and any ballast combined less than 100 millimeters (4 inches)?

If specified, are small arrow signs or vertical panels mounted above drums to supplement delineation?

If equipped with warning lights, do plastic drums have reinforcement around the warning light mounting hole or a similar precaution to prevent warning lights from separating upon impact?

It is recommended that the base and ballast combined for two-piece drums should not exceed 100 millimeters (4 inches) in height above the pavement; this ensures that vehicles can pass cleanly over them.

Ensure that drums with signs/panels are not blown over by the wind forces. This can be a problem because of the increased wind resistance that the added panels create.

Finally, if drums are equipped with warning lights, check to ensure that there is reinforcement around the lights' mounting hole. If no reinforcement is evident, ensure that the drums are replaced or some similar precaution is taken to prevent warning lights from separating from the drum and flying free in an impact from an errant vehicle. If the manufacturer of the drums recommends certain fastener types, ensure that these or an equivalent are used.

INSPECTION CHECKLIST -- Drums

	e Inspected:/ / _ Inspector:	
Loci	Mile Post and Roadway or Job Number	**************************************
Any	questions answered NO should be discussed with supervisor.	YES NO
1.	Are all drums plastic rather than metal?	
2.	Are the drums: orange in color, approximately 900 millimeters (36 inches) high, and at least 450 millimeters (18 inches) in diameter?	
3.	Measure and inspect the retroreflectorized stripes:	
	a. Do the stripes extend around the circumferences of drums?	
	b. Do the stripes measure 100 to 150 millimeters (4 to 6 inches)in width?	
	c. Does each drum have at least two orange and two white stripes?	
	d. Are the non-retroreflectorized spaces between stripes no more than 50 millimeters (2 inches) wide?	
4.	Do drums have closed tops which will not allow collection of construction or other debris?	
5.	Are the drums free from heavy objects placed on their tops?	
6.	If 1-piece drums are specified, are they weighted with a maximum of 23 kilograms (50 pounds) of sand (or recycled rubber tire sidewalls)?	
7.	If 2-piece drums are specified, are they weighted with a minimum of 13 kilograms (30 pounds) and a maximum of 35 kilograms (75 pounds) of sand placed in one or two sandbags, or a sand-filled base (recycled rubber tire sidewalls may also be used)?	
8.	Are the drums in acceptable condition?	
9.	Is the array of drums acceptable?	
10.	If drums are used at a dropoff, are the drums on top of the dropoff?	
11.	If contractors secure two-piece drums to the pavement to keep them in place, are only nails or adhesives used to secure the drums?	
12.	For two-piece drums, is the height of the base and weight combined less than 100 millimeters (4 inches)?	
13.	If specified, are small arrow signs or vertical panels mounted above drums to supplement delineation?	
14.	If equipped with warning lights, do plastic drums have reinforcement around the warning light mounting hole or a similar precaution to prevent warning lights from separating upon impact?	
	For questions answered NO, state the question number and problem:	
	State the action resulting from questions answered NO:	
	e and date that the problem was resolved:	

Module VIII.E. Type I, II, & III Barricades

Participant's Notebook Text INTRODUCTION

Visual Aids
See Module VIII.
Channelizing
Devices

A barricade is defined as a portable or fixed device having from one to three rails, with appropriate markings, used to control traffic by closing, restricting, or delineating all or a portion of the right-of-way.

Type I and II are those barricades having one and two horizontal reflectorized members, respectively, attached to a mounting and usually employed to channelize traffic. Type III barricades have three horizontal reflectorized members, and are usually employed to close roads. Typical barricade configurations are shown in figure 8E-1.

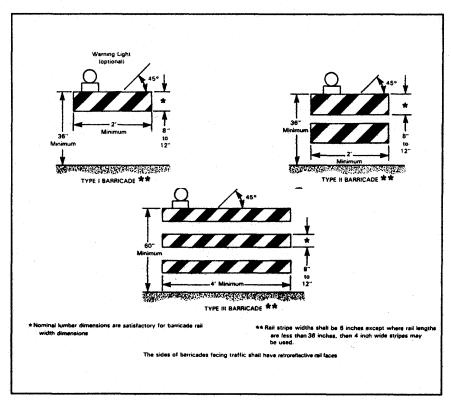


Figure 8E-1. Typical barricade configurations.

Are barricades made of lightweight materials with no rigid stay bracing for A-frame designs?

The barricades should be clean and constructed of lightweight materials. There should be no rigid stay bracing for A-frame designs. Lightweight materials and the absence of stay bracing are required to achieve the desired impact performance in the event of impact by an errant vehicle.

Are barricades placed perpendicular to traffic flow?

When placed across an intersection, are barricades set back a minimum of 9 meters (30 feet) from the intersection?

Are Type III barricades placed so that drivers have adequate stopping sight distance?

In addition, though the TCP ultimately dictates placement, barricades should, in general, be placed perpendicular to traffic flow. This is desirable because it is possible for barricade rails to pass through the windshield if they are aligned parallel to traffic. Similarly, when barricades are used at an intersection, they should be set back a minimum of 9 meters (30 feet) from the intersection. This is done to ensure adequate offset from the cross traffic, which would be travelling parallel to the barricade rail orientation. Also, a drive-through inspection is necessary to determine if drivers have adequate stopping sight distance from any Type III barricades used.

Do the barricades conform to the correct dimensions according to the MUTCD?

Type I and II barricades should:

- Be at least 900 millimeters (36 inches) tall.
- Have a rail width of 200 to 300 millimeters (8 to 12 inches).
- Have a minimum rail length of 0.6 meters (2 feet).
- Have stripes that are 150 millimeters (6 inches) wide, except where rail lengths are less than 900 millimeters (36 inches), then 100-millimeter (4-inch) stripes may be used.

Type III barricades should have the following basic dimensions:

- Height: 1.5 meters (5 feet)
- Rail width: 200 to 300 millimeters (8 to 12 inches)
- Rail length: 1.2 meters (4 feet)
- Stripe width: 150 millimeters (6 inches)

If barricades face traffic from opposite directions, are there back-to-back rails with stripes sloping downward in the direction traffic is to pass on both sides?

Barricades should be placed so that the diagonal stripes on the faces of the barricades slope down toward the side upon which traffic is to pass. Make sure the side of the barricade facing passing traffic is retroreflectorized. Barricades facing traffic from opposite directions must be checked to ensure that they have back-to-back rails with stripes sloping in the correct directions.

Are barricade rail stripes alternately orange and white? Do all sides of the barricades facing traffic have retroreflective rail faces?

The sheeting on the barricade rails should consist of alternating orange and white stripes. All sides of the barricade facing traffic should have retroreflective rail sheeting. On Type I barricades ONLY, additional unstriped horizontal panels may be added for stability.

When Type III barricades close a roadway, are they provided with gates or movable sections that can be closed when work is not in progress or with indirect openings to discourage public entry?

When a highway is legally closed but access is still allowed for local traffic, does the Type III barricade permit local access, that is, does it not extend completely across the roadway?

When a road is closed by a Type III barricade, but work vehicles or equipment are still permissible, the Type III barricade should provide gates or movable sections that can be closed when work is not in progress. Failing this, the barricade should provide only indirect openings to discourage public entry. In situations where a highway is legally closed but access is still needed for local traffic, check that the Type III barricade provides an access space suitable for this local traffic to pass, but generally discourages other traffic.

Are barricades ballasted and/or supported so they are not easily blown over by wind or traffic?

Are only sandbags or recycled rubber tire sidewalls used as ballast and only placed on the bottom of the barricade?

Barricade rails should be supported so they are seen by drivers and so they are not easily blown over by wind or traffic. Sandbags or recycled rubber tire sidewalls

can be used as ballast. These weights should be placed only on the barricade bases rather than on any rails, so that the weights are less likely to damage vehicles in an impact. Check all the barricades to ensure that they are not ballasted by rocks, chunks of concrete, or any other heavy object.

Does the appropriate regulatory sign supplement the barricade (See MUTCD Sections 2B-39- Road Closed Sign (R11-2) and 2B-40- Local Traffic Only Sign (R11-3 and R11-4))?

Check to ensure that the appropriate type of regulatory sign, if any, is in place according to the requirements of the TCP. Refer to MUTCD Sections 2B-39 (Road Closed Sign (R11-2)) and 2B-40 (Local Traffic Only Sign (R11-3)) for two examples of acceptable types of regulatory signs that may be mounted on a barricade.

If advance warning or guide signs or lights are mounted on barricades, are they specified in the TCP?

If advance warning or guide signs or lights are mounted on barricades, check that they are correct according to the TCP.

Are barricades visibly wider than the signs mounted on them? Do signs mounted on Type III barricades cover less than 50 percent of the top two rails and less than 33 percent of the total area of all three rails?

Signs installed on barricades should be no wider than the barricades supporting them. As a general rule, if barricades support both signs and warning lights, the barricades should be at least as wide as the signs plus 300 millimeters (12 inches) for each warning light. Signs mounted on Type III barricades should not cover more than 50 percent of the top two rails or 33 percent of the total area of the three rails.

Are barricades constructed and signs attached with approved fasteners (carriage bolts, shanks, and lag screws)? For the stand-type support, is the brace constructed of 2x4 or smaller lumber?

Type III barricades should be constructed using only approved fasteners. If these are not specified in the TCP, check to ensure that only carriage bolts, shanks, and lag screws are used for load-bearing connections. Nails may not be used to fasten signs to the barricade.

A stand-type support for barricades is pictured in Figure 8E-2. A typical stand of this type for a Type III Barricade is a simple cross member attached horizontally at the bottom of the vertical post support. It may also have additional 2x4 angle braces to stabilize the barricade in high winds. Nothing larger than a nominal 2x4 should be used for these braces to prevent potential impact problems for small vehicles.

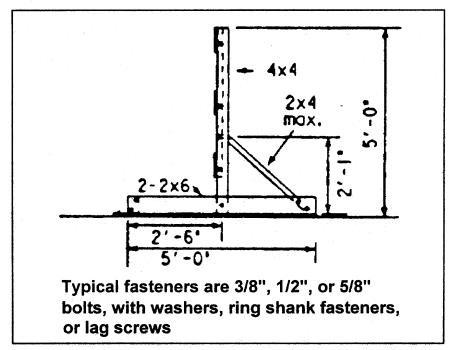


Figure 8E-2. Type III barricade stand supports.

Type III barricades also employ post-mounted supports. Braces on these supports should not be used and the post should have an adequate embedment depth to ensure that the barricade will not be blown over by wind loads.

Is the array of barricades acceptable?

Barricade panels are **acceptable** if they are not deformed to an extent so as to decrease the panels' target value. There may be several abrasions on the surface but very little loss of retroreflective sheeting. The orange is vivid and the stripes provide contrast.

Barricade panels are **marginal** if there are numerous surface abrasions through the panel surface, or if there is fading evident. There should not be large areas of residue or missing retroreflective material. The orange should be vivid and the stripes provide contrast.

Barricade panels are **unacceptable** if the surface is marred over a high percentage of its area, there is noticeable loss of retroreflectivity, or obvious color fading. Panels with asphalt splatter and/or cement slurry, or any combination of missing and covered retroreflective material, would also make the panel unacceptable.

INSPECTION CHECKLIST -- Barricades (Types I, II, & III)

	ation of Device: Mile Post and Roadway or Job Number	
ny	questions answered NO should be discussed with supervisor.	YES
-	Are barricades made of lightweight materials with no rigid stay bracing for A-frame designs?	
	Are barricades placed perpendicular to traffic flow?	
	When placed across an intersection, are barricades set back a minimum of 10 meters (30 feet) from the intersection?	-
	Are Type III barricades placed so that drivers have adequate stopping sight distance?	-
	Do Type I, II, and III barricades conform to the dimensions given in the MUTCD?	
	If barricades face traffic from opposite directions, are there back-to-back rails with stripes sloping downward in the direction traffic is to pass on both sides?	******
	Are barricade rail stripes alternately orange and white?	
•	Do all sides of barricades facing traffic have retroreflective rail faces?	
	When Type III barricades close a roadway, are they provided with gates or movable sections that can be closed when work is not in progress, or with indirect openings to discourage public entry?	
Э.	When a highway is legally closed but access is still allowed for local traffic, does the Type III barricade permit local access; that is, does it not extend completely across the roadway?	
1.	Are barricade rails supported so they are not easily blown over by wind or traffic?	
2.	Are only sandbags or recycled rubber tire sidewalls used as ballast and only placed on the bottom of the barricade?	
3.	Does the appropriate regulatory sign supplement the barricade (See MUTCD Sections 2B-39- Road Closed Sign (R11-2) and 2B-40- Local Traffic Only Sign (R11-3 and R11-4))?	
4.	If advance warning or guide signs or lights are mounted on barricades, are they specified in the TCP?	
	Are barricades visibly wider than the signs mounted on them?	
6.	Do signs mounted on Type III barricades cover less than 50 percent of the top two rails and less than 33 percent of the total area of all three rails?	
7.	Are barricades constructed and signs attached with approved fasteners (carriage bolts, shanks, and lag screws)?	
8.	For the stand-type support, is the brace constructed of 2x4, or smaller, lumber?	
€,	Is the array of barricades acceptable?	
	For questions answered NO, state the question number and problem:	
	State the action resulting from questions answered NO:	
		

Module VIII.F. Portable Barrier

PRESENTATION OPTIONS

There are no instructions for presenting this module, as the use of portable barriers as channelizers are rarely their main function. The slide presentation in Module VIII of this Instructor's Guide does not mention portable barriers in this capacity, as its importance to the overall topic of inspection of channelizing devices is minor. However, a section on inspection of the channelizing aspects of barriers was included in the Participant's Notebook for completeness. Some new devices are available, such as water-filled barriers for low-speed channelizing applications, that may be of more importance in the future. These new devices are fairly rare, however, and it is unlikely that many requesting agencies will express great interest in this topic.

If an agency does request more in-depth information on this module, it may be appropriate to go through the checklist at the end of the Participant's Notebook module with the class or find some additional literature on the new barrier devices that are being used as channelizers.

Module VIII.F. Portable Barrier

Participant's Notebook Text INTRODUCTION

Visual Aids
None

In general, portable barriers are needed for protective, not channelizing, purposes. As such, the decision to use portable barriers should be determined by engineering analysis and the protective requirements of the location, not the channelizing needs. A more complete treatment of inspection aspects of portable concrete barriers (PCBs) is given in section XII.A. Here, information is given on those aspects of PCB inspection that are specific to when the device is used as a channelizing device.

Do portable barriers serving as channelizers meet the requirements for standard taper lengths?

Are the portable barriers supplemented with other types of delineation? Is the use of portable barriers as a channelizing device for merging tapers avoided?

In certain cases, it is possible for portable barriers serving a protective function to be used for the additional duty of channelizing traffic. When serving this additional function, the barrier taper shall meet standard channelizing taper lengths. These are given in Part VI of the MUTCD. The channelizing barrier shall be supplemented by standard delineators, channelizing devices, or pavement markings. It is very important that portable barriers be used only for channelizing and not as a merging taper, except in very specialized low-speed urban areas.

Are the first two warning lights attached to the ends of the barrier flashing warning lights and the rest steady-burn warning lights?

If warning lights are used to supplement the portable barriers used as a channelizing device, the first two lights attached to the ends of the barrier should be flashing warning lights; the others should be steady-burn warning lights.

INSPECTION CHECKLIST -- Portable Barrier

_	quartiens analysms	Mile Post and Roadway or Job Number		
_	avastians answers			
	questions answere	d NO should be discussed with supervisor.	YES	NO
1.	Do portable barriostandard taper len	ers serving as channelizers meet the requirements for agths?		
2.	Are the portable b	parriers supplemented with other types of delineation?		
3.	Is the use of porta avoided?	able barriers as a channelizing device for merging tapers		
4.		warning lights attached to the ends of the barrier flashing d the rest steady-burn warning lights?		-
	For questions answ	vered NO, state the question number and problem:		
-	بمني ويفيس لهرده سودون ويدو فسمو دادو والمراجع			
	State the action res	ulting from questions answered NO:		
Γime	and date that the p	roblem was resolved:		
	ture and Title:			

Module VIII.G. Temporary Raised Islands

Participant's Notebook Text INTRODUCTION

Visual Aids
See Module VIII.
Channelizing
Devices

Temporary raised islands may be used to supplement channelizing devices and pavement markings to separate traffic flows in two-lane, two-way operations (TLTWO). Pavement edge lines may be placed on the island itself. Islands may also have application in other than TLTWO where physical separation of traffic from the temporary traffic control zone is not required.

There is limited operational experience with the temporary raised island. As such, there is not consensus on the traffic and geometric conditions that warrant its use. There are also few well-defined criteria for installation and inpsection of the device. There are a few points to check if a temporary raised island is present during a work zone inspection:

Is the speed limit in the road section where the temporary raised islands are used 70 kilometers per hour (45 miles per hour) or less, except where recommended by an engineering study?

The temporary raised island should only be used on roadways with speeds of 70 kilometers per hour (45 miles per hour) or less except when recommended by an engineering study.

Does the island have the basic cross-section dimension of 100 by 450 millimeters (4 by 18 inches) with rounded or chamfered corners?

Does the island have sufficient compaction with a smooth top and sides?

The most common type of temporary raised island is 100 millimeters (4 inches) in height and 450 millimeters (18 inches) wide and has rounded or chamfered corners. This design is pictured in Figure 8G-1. Check to ensure that the raised island is similar in design to this one, unless otherwise specified in the traffic control plan. They may be constructed of Portland Cement Concrete or bituminous concrete. The island should be checked to ensure that there is sufficient compaction with a smooth top and sides.

If the island is constructed on top of a concrete pavement, which will be the final surface, or other pavement where residual stains from removal of the island may confuse traffic, has a bond breaker or surface protector been applied prior to installation?

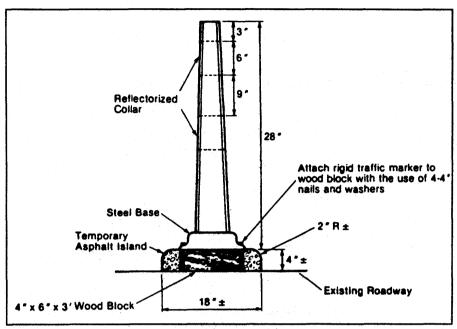


Figure 8G-1. Typical design of temporary raised island.

Bond breaker or surface protector should be applied to concrete pavements prior to installation of the temporary raised island. These compounds allow easier removal of the island and reduce the likelihood of residual stains on the pavement surface.

On superelevated, transition, or other sections where ponding of water may be a problem, have transverse drainage slots or suitable alternative measures been constructed?

Raised islands between traffic lanes can sometimes cause problems with water ponding on the roadway. This is a real safety hazard for both construction worker and motorist. In areas where it appears that this may be a problem, (superelevated, transition sections) check to see that some means has been taken to ensure that water ponding does not occur. This may consist of transverse drainage slots through the raised island body or other similar measures.

Are retroreflectorized yellow edge lines installed adjacent to or on the island? Where required, is the island painted with yellow retroreflectorized paint? Have the tubular markers, provided for delineation, been properly secured?

The temporary raised island must be supplemented with other delineation or channelization. Check to ensure that tubular markers and pavement markings are used in combination with the temporary raised island, unless otherwise specified in the TCP. If tubular markers are present, check to ensure that they have been properly secured. Often, the TCP will also call for the island to be painted on its sides and/or top with yellow retroreflectorized paint.

INSPECTION CHECKLIST -- Temporary Raised Islands

	on of Device: Mile Post and Roadway or Job Number		
Any	questions answered NO should be discussed with supervisor.	YES	NC
1.	Is the speed limit in the road section where the temporary raised islands are used 70 kilometers per hour (45 miles per hour) or less, except where recommended by an engineering study?		
2.	Does the island have the basic cross-section dimension of 100 by 450 millimeters (4 by 18 inches) with rounded or chamfered corners?	***************************************	
3.	Does the island have sufficient compaction with a smooth top and sides?	****	
4.	If the island is constructed on top of a concrete pavement, which will be the final surface, or other pavement where residual stains from removal of the island may confuse traffic, has a bond breaker or surface protector been applied prior to installation?		
5.	On superelevated, transition, or other sections where ponding of water may be a problem, have transverse drainage slots or suitable alternative measures been constructed?		
6.	Are retroreflectorized yellow edge lines installed adjacent to or on the island?		
7.	Where required, is the island painted with yellow retroreflectorized paint?		
8.	Have the tubular markers, provided for delineation, been properly secured?		-
	For questions answered NO, state the question number and problem:		
-	State the action resulting from questions answered NO:		

Module IX.A. Pavement Markings

OV9A-I-PAVE

INSTRUCTION SUMMARY

Duration:

10 minutes

Objective:

To educate students on the inspection techniques for standard pavement markings

Content:

Module IX Overview, Inspection Frequency, TCP Compliance, Locations, Patterns,

Cycle Lengths, Colors, Day/Night Inspection, Marking Quality

Equipment:

Overhead Projector

Aids:

9 Overheads

PRESENTATION OPTIONS

The participant's notebook information was developed from information in the new Part VI of the MUTCD, the Roadside Design Guide, along with material from the Texas DOT's "Inspector's Training Manual." Some agencies may publish specific duties of inspectors that can be substituted. If nothing specific to the agency is available, question participants about how their agency is different. Standards for device quality were obtained from ATSSA literature. If discrepancies exist between a specific agency's policy and the standards from the MUTCD, this should be acknowledged with an additional admonition that most agencies will eventually adopt the new Manual.

LESSON PLAN

Introduction

Markings/Delineators covered in Module IX. of the Participant's Notebook

OV9-1 - MARKINGS/DELINEATORS

OV9A-5 - CC

- The topics covered are:
 - Pavement Markings standard pavement markings as used in work zones.
 - Interim Markings short-term markings used in work zones.
 - Raised Pavement Markers both standard RPMs and temporary flexible-tab type markers used in work zones.
 - Delineators post-mounted delineators used in work zones

OV9A-1 - PAVEMENT MARKINGS

1G-168

- Pavement markings can be a maintenance problem.
- Recommended to inspect them at least once a week.
- Day and night inspections must be performed; the daytime appearance of a pavement marking says nothing about its nighttime retroreflective performance.
- Also, inspectors should consider to doing inspections on or near days of installation, Paremoval, or other changes in the pavement marking setup as this is the time that Day and night inspections y less than the pavement, the daytime appearance.

OV9A-2 - TGP: GOVIPLANCE
Also, inspectors should consider re-doing inspections on or near days of installation.

Also, inspectors should consider re-doing inspections on or near days of the firms that robbiously the TCP must be checked; marking setup, as this is the time that probably with its specifications.

QV9A-3 - INARPOLEABLE MARKINGS

- Inapplicable markings are one of the biggest problems with pavement marking installations.
- The problem is related to the tack of good nighttime inspection programs.
- OV9A-3 IN Markings can appear to be obliterated during daytime inspections, but can re-appear at night with only a few beads and bigment at the pavement surface.

 Inapplicable markings beads and bigment at the pavement surface.

OV9A-4 - PHOTO OF INAPPLICABLE MARKINGS PAINTED OVER IN BLACK

- Here, the markings have been painted over in black.
- We can see that not all of the white markings underneath have been obliterated. This installation will almost definitely show up as several criss-grossing white lines
- This shit allation will almost definitely show up as several criss-crossing white lines are several criss-crossing are several criss-cross-cr location af this were ain a work zone ituation for rootorists, and any workers near this

OV9A-5 - COLORS

OLORS

- Colors of pavement markings convey a specific message.
- White markings saparate traffic traveling in the same direction; yellow separates traffic traveling in opposite directions ling in the same direction; yellow separates
- Width and excle length should be checked against TCP.
- As moted in Participant's Notebook the most compon cycle lengths are 12 meters (40 feetherwith #3 metern 10 foot) stripe and Structor (30 foot) gapuns are

), with a 3-meter (10-foot) stripe and 9-me ter (30-foot) gar

OV9A-6 - PHOTO OF MISAPPLIED YELLOW MARKINGS

- Here is an example of another inapplicable marking, also in the wrong color for traffic traveling in the same direction.
- This is probably a remnant of an earlier detour or crossover, but the remaining lines present an unclear message to motorists.
- Situations like this happen in work zones frequently, and, as inspectors, it is your duty to see they are corrected, as they present a great liability risk.

OV9A-7 - RETROREFLECTIVITY

- A good way to check for a proper bead/pigment/binder system is to look for a color shift at night.
- Markings should appear the same color during the day and at night.
- The sunlight/shadow test (describe test to class) is a good way to check the bead distribution without having to perform a nighttime test.
- Note that the sunlight/shadow test is not a substitute for a nighttime inspection; markings that pass the test may still not function as desired at night.
- The best way to check retroreflectivity is a nighttime drive-through
- Look for characteristic "glow" along the entire length and width illuminated by the headlights; use low-beam headlights, as this is the way 90 percent of driving is done.

OV9A-8 - DEVICE QUALITY STANDARDS

- Check the quality of the markings as specified by the ATSSA Quality Guide.

VISUAL AIDS

OV9-1 - MARKINGS/DELINEATORS

- Pavement markings
- Interim markings
- Raised pavement markers
- Delineators

OV9A-1 - PAVEMENT MARKINGS

- Inspect at least weekly
- Day and night inspections
- On or near days of installation and removal

OV9A-2 - TCP COMPLIANCE

- Prior to marking installation, is the marking material that which is specified in the TCP or specifications?
- Are the locations and patterns of markings installed according to the TCP?

OV9A-3 - INAPPLICABLE MARKINGS

- Are markings no longer applicable completely removed or obliterated so that they are no longer visible?
 - Daytime
 - Nighttime
 - Markings that seem obliterated during daytime inspections may still show up at night.

OV9A-4 - PHOTO OF INAPPLICABLE MARKINGS PAINTED OVER IN BLACK

OV9A-5 - COLORS

- Are the colors of the markings in accordance with the TCP so that white separates traffic traveling in the same direction and yellow separates traffic traveling in opposing directions?
- Do the width and cycle length of broken lines comply with the TCP?

OV9A-6 - PHOTO OF MISAPPLIED YELLOW MARKINGS

OV9A-7 - RETROREFLECTIVITY

- Are the markings the same color (white markings appear white, yellow markings appear yellow) both during the day and at night?
- Perform the sunlight/shadow test on the markings during the daytime and observe the bead distribution. Is there sufficient number and uniformity of embedded beads?
- During the night inspections, under low-beam headlights, do the markings "glow" along the entire length and width illuminated by the headlights?

OV9A-8 - DEVICE QUALITY STANDARDS

Are standard markings in "acceptable" condition?

- Acceptable

- All markings in place and meeting all material specifications.

- Marginal

Ten percent of all tape, paint, message or symbol, two consecutive skip lines, or 16 continuous meters (50 feet) of solid line missing or not visible at night.

- Unacceptable

- Exceeds limits of missing material specified as "marginal."

Module IX.A. Pavement Markings

Particpant's Notebook Text INTRODUCTION

Visual Aids
OV9-1 Mrk/Delin

Pavement markings should be inspected at least once a week, and inspections should be done both during the day and at night. In addition, it is a good idea to inspect pavement markings on days (or shortly after) they are being installed or removed, as this is the time that problems are most likely to occur.

OV9A-1 Pavement Markings

Prior to marking installation, is the marking material as specified in the TCP or Specifications?

OV9A-2 TCP Compliance

For inspections prior to marking installation, check to ensure that the marking material being used is the same as specified in the TCP or specifications.

Drive through the work zone. Are the locations and patterns of markings installed according to the TCP?

Drive through the work zone to inspect the markings. Check to ensure that the locations and patterns of markings installed match that specified in the TCP. In particular, check to ensure that the lines are the proper width according to the TCP, and that their cycle length on skip (broken) lines is correct. This cycle should normally be 12 meters (40 feet) from the start of one line to the start of the next line. The stripes are normally then 3 meters (10 feet) in length, with a 9-meter (30-foot) gap, unless otherwise specified in the TCP.

OV9A-3 Inapplicable Markings

Drive through the work zone. Are markings no longer applicable completely removed or obliterated so that they are not visible in the daytime or nighttime?

Drive through the work zone both during the day and at night. Make sure that markings that are no longer applicable have been completely removed or obliterated so that they are not visible either day or night. The day and nighttime drive-throughs are both necessary because it is possible for a marking to be nearly invisible during the day, but to still retroreflect enough light at night to cause a confusing situation for motorists passing through the work zone.

It is very important that inspectors ensure that inapplicable pavement markings are not visible at night. Often, these pavement markings are relied upon by drivers at night as their main source of information about the driveable path through the work zone. Additionally, drivers tend to rely more on these markings at night and in inclement weather, times when accidents most likely occur. As a result,

OV9A-4 Photo of inapplicable markings painted over in black

it is critical that inspectors ensure there are no markings on the road that could provide false or misleading information to drivers in these circumstances, possibly causing injuries, property damage, or liability for the responsible agencies.

Are the colors of the markings in accordance with the TCP so that white separates traffic traveling in the same direction and yellow separates traffic traveling in the opposing direction?

OV9A-5 Colors

Do the width and cycle length of broken lines comply with the TCP?

When performing the drive-through inspection of the work zone, check to ensure that the lines are correct as follows:

OV9A-6 Photo of misapplied yellow markings

- White lines separate traffic traveling in the same direction.
- Yellow lines separate traffic traveling in opposing directions.
- Width of lines is correct according to the TCP.
- Cycle length of broken lines is correct according to the TCP. Normal cycle length is 12 meters (40 feet); normal cycles are 3-meter (10-foot) stripe, 9-meter (30-foot) gap.

Are the markings the same color (white markings appear white and yellow markings appear yellow) during the day and night?

OV9A-7 Retroreflectivity

Also, drive through the work zone at night to ensure that white and yellow lines both appear to be the same color day and night. This is necessary because, while pavement markings may appear acceptable during the day, they may not contain enough beads or high-quality pigment to appear the same color at night, and may therefore not provide sufficient information for motorists at night.

Perform the sunlight/shadow test on the markings during the daytime and observe the bead distribution. Is there sufficient number and uniformity of embedded beads?

The sunlight/shadow test can be performed by standing with the sun at your back until the shadow of your head just touches the bottom of the marking. Be careful to watch traffic during this process and ensure that you do not place yourself in a hazardous location in order to observe the marking in this manner.

With the shadow of your head on the line, the marking around your shadow should "shine" back at you as the embedded beads retroreflect the sun's bright light back to you. The glow created should be dense, bright, and uniformly cover the width of the pavement marking. Dull or dark areas are a sign of inadequate bead

distribution or embedment. A bright glow that appears only across a portion of the marking may be a sign of a malfunctioning bead gun on the striping machine.

Note that successfully passing this test does not guarantee that the marking will perform well at night. A nighttime inspection is still needed to be sure of good nighttime performance. However, this test is a good way to test initial bead distribution, without having to go out to the job site at night. It is particularly useful to perform this test immediately after a marking has been installed to check bead gun functioning.

During the night inspection and under low-beam headlights, do the markings "glow" along the entire length and width illuminated by the headlights (no evidence of dark bands or stripes within the markings)?

During the night inspection, under low-beam headlights, check to ensure that the markings "glow" along the entire length and width illuminated by the headlights. It is possible for a marking to show evidence of dark bands or stripes. This is an unacceptable condition for good nighttime delineation.

Are standard markings in "acceptable" condition?

OV9A-8 Device Quality

Refer to the following paragraphs for descriptions of acceptable, marginal, and unacceptable pavement markings:

- Acceptable: All pavement marking tape or paint required (solid lines and skip lines) is in place and meets all material specifications.
- Marginal: No more than 10 percent of all tape, paint, message or symbol, no more than 2 consecutive skip lines, or no more than 16 continuous meters (50 feet) of solid line is missing.
- Unacceptable: More than 10 percent of all tape, paint, message or symbol, more than two consecutive skip lines, or more than 16 continuous meters (50 feet) of solid line is missing.

INSPECTION CHECKLIST -- Pavement Markings

Da	te Inspected:/ / Inspector:	
Lo	cation of Device:	
	Mile Post and Roadway or Job Number	
An	ny questions answered NO should be discussed with supervisor.	YES NO
1.	Prior to marking installation, is the marking material as specified in the TCP or Specifications?	
2.	Drive through the work zone. Are the locations and patterns of markings installed according to the TCP?	
3.	Drive through the work zone. Are markings no longer applicable completely removed or obliterated so that they are not visible in the:	
	a. Daytime?	
	b. Nighttime?	
4.	Are the markings applied according to the TCP:	
	a. White - separating traffic traveling in the same direction?	
	b. Yellow - separating traffic traveling in the opposing direction?	
	c. Width?	
	d. Broken lines - cycle length of 12 meters (40 feet) (from the start of one line to the start of the next line), with a line length of 3 meters (10 feet)?	<u></u>
5.	Are the markings the same color (white markings appear white and yellow markings appear yellow) during the day and night?	
6.	Perform the sunlight/shadow test on the markings during the daytime and observe the bead distribution. Is there sufficient number and uniformity of embedded beads?	
7.	During the night inspection, under low-beam headlights, do the markings "glow" along the entire length and width illuminated by the headlights (no evidence of dark bands or stripes within the markings)?	
8.	Are standard markings in "acceptable" condition?	
	For questions answered NO, state the question number and problem:	
********	State the action resulting from questions answered NO:	
	me and date that the problem was resolved:	
Sig	gnature and Title:	

Module IX.B. Interim Markings

INSTRUCTION SUMMARY

Duration:

5 minutes

Objective:

To educate students on the inspection techniques for short-term interim markings

Content:

TCP Compliance, Locations, Patterns, Cycle Lengths, Colors, Day/Night Inspection,

Marking Quality, Duration of Use

Equipment:

Overhead Projector

Aids:

3 Overheads

PRESENTATION OPTIONS

The lesson plan for this module was developed with the assumption that Module IX.A. would be taught immediately preceding this module. Since many of the inspection items are redudnant with that module, they are only touched on briefly here. If, for some reason, the requesting agency wishes a presentation on this topic, but not for standard pavement markings, many of the Module IX.A. overheads could be used for this module to teach it in greater detail.

The participant's notebook information was developed from information in the new Part VI of the MUTCD, the Roadside Design Guide, along with material from the Texas DOT's "Inspector's Training Manual." Some agencies may publish specific duties of inspectors that can be substituted. If nothing specific to the agency is available, question participants about how their agency is different. Standards for device quality were obtained from ATSSA literature. If discrepancies exist between a specific agency's policy and the standards from the MUTCD, this should be acknowledged with an additional admonition that most agencies will eventually adopt the new Manual.

LESSON PLAN

Introduction

Interim Markings are covered in Module IX.B. of the Participant's Notebook.

OV9B-1 - INTERIM MARKINGS

- Interim markings are intended for temporary use until it is possible to install full MUTCD-compliant pavement markings.
- The types of interim markings used are:

- Temporary tape
- Flexible tab-type markers
- Warning signs sometimes qualify as a type of interim marking in certain special situations.

OV9B-2 - INSPECTION

- Inspection of interim markings is basically identical to that of inspecting standard pavement markings for the following criteria:
 - TCP Compliance
 - Locations
 - Patterns
 - Cycle lengths
 - Stripe dimensions (width)
 - Colors
 - Inapplicable markings
 - Retroreflectivity
 - Device quality

OV9B-3 - DURATION OF USE

- Less than 2 weeks of use for interim markings.
- NO PASSING ZONE signs on unmarked roads used for 3 calendar days or less.
- Low-volume road should be unmarked for a period of time based on local agency policy.

VISUAL AIDS

OV9B-1 - INTERIM MARKINGS

- Temporarily replace permanent markings
- Types
 - Temporary tape
 - Flexible tabs
 - Warning signs (special situations)

OV9B-2 - INSPECTION

- Similar to inspection of pavement markings
 - TCP Compliance
 - Locations
 - Patterns
 - Cycle lengths
 - Stripe dimensions (width)
 - Colors
 - Inapplicable markings
 - Retroreflectivity
 - Device quality

OV9B-3 - DURATION OF USE

- Have interim markings been in place less than 2 weeks?
- On a 2- or 3-lane road with no-passing zones, where NO PASSING ZONE signs have been used in lieu of pavement markings, has the road been unmarked for a period of 3 calendar days or less?
- Review your TCP, specifications, and your agency's MUTCD policy for markings on low-volume roads. Has the low-volume road been unmarked for a period longer than permitted by policy?

Module IX.B. Interim Markings

Participant's Notebook Text INTRODUCTION

Visual Aids

Interim markings are used temporarily until it is possible to install pavement markings that meet the full MUTCD standards for pavement markings. They normally consist of lightweight, or temporary tape, flexible tab-type markers, or a similar system. In certain special cases, signs are used in lieu of interim markings.

OV9B-1 Interim Markings

Prior to marking installation, is the marking material that which is specified in the TCP or Specifications?

OV9B-2 Inspection

Drive through the work zone. Are the locations and patterns of markings installed according to the TCP?

For inspections prior to marking installation, check to ensure that the marking material being used is the same as specified in the TCP or specifications.

Drive through the work zone to inspect the markings. Check to ensure that the locations and patterns of markings installed match that specified in the TCP. In particular, check to ensure that the lines are the proper width according to the TCP, and that their cycle length on skip (broken) lines is correct.

Have interim markings been in place less than 2 weeks? On a 2- or 3-lane road with no-passing zones, where NO PASSING ZONE signs have been used in lieu of pavement markings, has the road been unmarked for a period of 3 calendar days or less?

OV9B-3 Duration of use

Normally, interim pavement markings should not be in place for more than 2 weeks. In certain special situations, no-passing zones may be identified by using signs rather than pavement markings. This should only be done for a period of 3 calendar days or less for a 2- or 3-lane road.

Review the TCP, specifications, and your state's MUTCD policy for markings on low-volume roads. Has the low-volume road been unmarked for a period longer than permitted by the policy?

The only time signs may be used in lieu of pavement markings for a longer period of time that 3 calendar days is on low-volume roads, and then only when this is acceptable according to the State's or highway agency's policy.

Do the interim markings have a standard cycle length of 12 meters (40 feet) with a stripe length of at least 1.2 meters (4 feet), except at road sections with severe curvature where half-cycle lengths and 0.6 meters (2 feet) stripes may be used?

Cycle lengths for interim markings should normally be 12 meters (40 feet) from the start of one line to the start of the next line. The stripe length for interim skip lines may be shorter than for permanent pavement markings, but they should be at least 1.2 meters (4 feet). On road sections with severe curvature, half-cycle lengths of 6 meters (20 feet)) with 0.6-meter(2-foot) skip stripes are usually permissible. If this seems questionable, refer to the State MUTCD and Special Provisions.

Are the markings applied according to the TCP so that white markings separate traffic traveling in the same direction and yellow markings separate traffic traveling in the opposing direction?

Is the width of the interim markings correct according to what is called for in the TCP?

When performing the drive-through inspection of the work zone, check to ensure that the lines are correct according to the TCP as follows:

- White lines separate traffic traveling in the same direction.
- Yellow lines separate traffic traveling in opposing directions.
- Width of markings is correct according to the TCP.

Are the markings the same color (white markings appear white and yellow markings appear yellow) during the day and night?

Also, drive through the work zone at night to ensure that white and yellow lines both appear to be the same color day and night. This is necessary because it is possible for pavement markings to appear acceptable during the day, while they may not contain enough beads or high-quality pigment to appear the same color at night and may therefore not provide sufficient information for motorists at night.

Are markings that are no longer applicable to current conditions in the work zone completely removed so that they are not visible either during the day or at night?

Drive through the work zone both during the day and at night. Make sure that markings that are no longer applicable have been completely removed or obliterated so that they are not visible either day or night. The day and nighttime drive-throughs are both necessary because it is possible for a marking to be nearly invisible during

the day, but to still retroreflect enough light at night to cause a confusing situation for motorists passing through the work zone.

During the night inspection, and under low-beam headlights, do the markings "glow" along the entire length and width illuminated by the headlights (no evidence of dark bands or stripes within the markings)?

During the night inspection and under low-beam headlights, check to ensure that the markings "glow" along the entire length and width illuminated by the headlights. It is possible for a marking to show evidence of dark bands or stripes. This is an unacceptable condition for good nighttime delineation.

Are interim markings in "acceptable" condition?

Refer to the following paragraphs for descriptions of acceptable, marginal, and unacceptable pavement markings:

- Acceptable: All pavement marking tape (or paint) required (solid lines and skip lines) is in place and meets all material specifications.
- Marginal: No more than 10 percent of all tape, paint, message or symbol, or no more than 2 consecutive skip lines or 16 continuous meters (50 feet) of solid line is missing.
- Unacceptable: More than 10 percent of all tape, paint, message or symbol, more than two consecutive skip lines, or more than 16 continuous meters (50 feet) of solid line are missing.

INSPECTION CHECKLIST -- Interim Markings

	e Inspected:/_/_ Inspector:ation of Device:	
200	Mile Post and Roadway or Job Number	
Any	y questions answered NO should be discussed with supervisor.	YES NO
1.	Prior to marking installation, is the marking material as specified in the TCP or Specifications?	
2.	Drive through the work zone. Are the locations and patterns of markings installed according to the TCP?	
3.	Have interim markings been in place less than 2 weeks?	
4.	On a 2- or 3-lane road with no-passing zones, where NO PASSING ZONE signs have been used in lieu of pavement markings, has the road been unmarked for a period of 3 calendar days or more?	
5.	Review the TCP, specifications, and your State's MUTCD policy for markings on low-volume roads. Has the low-volume road been unmarked for a period longer than permitted by the policy?	
6.	Do the interim markings have a standard cycle length of 12 meters (40 feet) with a stripe length of at least 1.2 meters (4 feet), except at road sections with severe curvature where half-cycle lengths and 0.6-meter (2-foot) stripes may be used?	
7.	Are the markings applied according to the TCP:	
	a. White - separating traffic traveling in the same direction?	
	b. Yellow - separating traffic traveling in the opposing direction?	
	c. Width?	
8.	Are the markings the same color (white markings appear white and yellow markings appear yellow) during the day and night?	
9.	Are markings that are no longer applicable to current conditions in the work zone completely removed so that they are not visible either during the day or at night?	
10.	During the night inspection and under low-beam headlights, do the markings "glow" along the entire length and width illuminated by the headlights (no evidence of dark bands or stripes within the markings)?	
11.	Are interim markings in "acceptable" condition?	
	For questions answered NO, state the question number and problem:	
	State the action resulting from questions answered NO:	
	ne and date that the problem was resolved:nature and Title:	

Module IX.C. Raised Pavement Markers

INSTRUCTION SUMMARY

Duration:

5 minutes

Objective:

To educate students on the inspection techniques for raised pavement markers

Content:

TCP Compliance, Locations, Patterns, Cycle Lengths, Colors, Day/Night Inspection,

Visibility Distance, Marker Quality

Equipment:

Overhead Projector

Aids:

4 Overheads

PRESENTATION OPTIONS

The lesson plan for this module was developed with the assumption that Module IX.A. and Module IX.B. would be taught immediately preceding this module. Since many of the inspection items are redundant with Module IX.A., they are only touched on briefly here. If, for some reason, the requesting agency wishes a presentation on this topic, but not for standard pavement markings, many of the Module IX.A. overheads could be used for this module to teach it in greater detail.

The participant's notebook information was developed from information in the new Part VI of the MUTCD, the Roadside Design Guide, along with material from the Texas DOT's "Inspector's Training Manual." Some agencies may publish specific duties of inspectors that can be substituted. If nothing specific to the agency is available, question participants about how their agency is different. Standards for device quality were obtained from ATSSA literature. If discrepancies exist between a specific agency's policy and the standards from the MUTCD, this should be acknowledged with an additional admonition that most agencies will eventually adopt the new Manual.

LESSON PLAN

Introduction

Raised Pavement Markers are covered in Module IX.C. of the Participant's Notebook

OV9C-1 - RAISED PAVEMENT MARKERS

- A wide variety of types of RPMs are available.
- However, the inspection of RPMs entails similar features as standard pavement markings for...

OV9C-2 - INSPECTION ITEMS

- TCP Compliance same as for pavement markings.
- Colors same as for pavement markings.
- Inapplicable Markers same as for pavement markings.
- Nighttime Visibility/Visibility Distances specified for RPMs are different.
- Device Quality Standards are similar, but also slightly different.

OV9C-3 - NIGHTTIME VISIBILITY DISTANCE

- RPMs and tabs should be checked for specified visibility distances both during the day and at night.

OV9C-4 - QUALITY STANDARDS

- The quality standards should be checked for adherence.
- The overhead and Participant's Notebook information is from the ATSSA Quality Standards.

VISUAL AIDS

OV9C-1 - RAISED PAVEMENT MARKERS

- Typical Configurations
 - Ceramic housing with small retroreflective insert
 - Snowplowable
- Many inspection items are similar as for pavement markings

OV9C-2 - INSPECTION ITEMS

- TCP Compliance
 - Location
 - Number
 - Placement
- Colors
 - White
 - Yellow

- Inapplicable markers
- Nighttime visibility
- Device quality standards

OV9C-3 - VISIBILITY DISTANCE

- During the drive-through inspection of raised pavement markers, are the markers visible from 90 meters (300 feet) during the daytime, and from 48 meters (160 feet) at night?
- Are flexible, retroreflective marker tabs visible from 60 meters (200 feet) during the daytime and from 48 meters (160 feet) under low-beam headlights at night?

OV9C-4 - QUALITY STANDARDS

- Are raised pavement markers in "acceptable" condition?
 - Acceptable
 - All RPMs in place and meeting specifications
 - Marginal
 - Ten percent RPMs missing or not visible.
 - Three consecutive RPMs missing or not visible.
 - Unacceptable
 - Exceeding numbers of missing devices specified as "Marginal."

Module IX.C. Raised Pavement Markers

Participant's Notebook Text INTRODUCTION

Visual Aids

Raised Pavement Markers (RPMs) are any type of marking that is raised off of the pavement surface to provide greater visibility to drivers, particularly during adverse weather conditions. RPMs normally consist of a ceramic housing to protect a small retroreflective insert to provide night visibility.

OV9C-1 Raised Pavement Markers

Prior to marker installation, is the type of marker as specified in the TCP or Specifications?

OV9C-2 Inspection items

For inspections prior to RPM installation, check to ensure that the RPMs being used are the same as specified in the TCP or specifications.

Drive through the work zone, are the locations, patterns, and spacing of markers and tabs installed according to the TCP?

Drive through the work zone to inspect the RPMs. Check to ensure that the locations and patterns of RPMs installed match that specified in the TCP. In particular, check to ensure placement and spacing of the RPMs are correct according to the TCP.

Are the colors of the markers applied according to the TCP so that white markers separate traffic traveling in the same direction and yellow markers separate traffic traveling in the opposing direction?

Are the markers the same color (white markings appear white and yellow markings appear yellow) during the day and night?

When performing the drive-through inspection of the work zone, check to ensure that the RPMs are the proper color as follows:

- White RPMs separate traffic traveling in the same direction.
- Yellow RPMs separate traffic traveling in opposing directions.

Also, drive through the work zone at night to ensure that white and yellow RPMs both appear to be the same color day and night. This is necessary because it is possible for RPMs to appear to be acceptable during the day, while their retroreflective faces may be inadequate to appear the same color at night, and may therefore not provide sufficient information for motorists.

Drive through the work zone. Are markers no longer applicable completely removed or obliterated so that they are not visible during the daytime, at night, or on wet pavement?

Drive through the work zone, ensuring that RPMs that are no longer applicable have been removed so that they cannot mislead drivers. If possible, inspections should also be made in various weather conditions, particularly while the pavement is wet, to discern if the inapplicable markings may be visible in these situations.

During the drive-through inspection of raised pavement markers, are the markers visible from 90 meters (300 feet) during the daytime and from 48 meters (160 feet) under low-beam headlights at night?

Are flexible-reflective marker tabs visible from 60 meters (200 feet) during the daytime and from 48 meters (160 feet) under low-beam headlights at night?

Drive-through the work zone both during the day and at night to inspect the RPMs. During the daytime, the markers should be visible from at least 90 meters (300 feet). At night, the markers should be visible from at least 48 meters (160 feet) under low-beam headlights.

If there are flexible tab-type markers on the site, they should be visible from at least 60 meters (200 feet) during the day and 48 meters (160 feet) at night under low-beam headlights.

Are raised pavement markers in "acceptable" condition?

Refer to the following definitions of acceptable, marginal, and unacceptable quality levels for RPMs:

- Acceptable: All RPMs required are in place and meet all material specifications.
- Marginal: No more than 10 percent of the total number of RPMs or no more than three consecutive RPMs are missing (or not visible from the specified distance).
- Unacceptable: More than 10 percent of the total number of RPMs or more than three consecutive RPMs are missing (or not visible from the specified distance).

OV9C-3 Visibility Distance

OV9C-4 Device Quality Standards

INSPECTION CHECKLIST -- Raised Pavement Markers

	te Inspected:/ /_ Inspector:	· .
LOC	Mile Post and Roadway or Job Number	
	마이트 보고 있는 것이 되었다. 그는 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은 사람들은	
An	ny questions answered NO should be discussed with supervisor. YES	NO
1.	Prior to marker installation, is it the type of marker specified in the TCP or Specifications?	
2.	Drive through the work zone. Are the locations, patterns, and spacing of markers installed according to the TCP?	-
3.	Are the markers applied according to the TCP:	
	a. White - separating traffic traveling in the same direction?	
	b. Yellow - separating traffic traveling in the opposing direction?	
4.	Are the markers the same color (white markings appear white and yellow markings appear yellow) during the day and night?	
5.	Drive through the work zone. Are markers no longer applicable completely removed or obliterated so that they are not visible:	
	a. During the daytime?	<u></u>
	b. During the nighttime?	
	c. On wet pavement?	
6.	During the drive-through inspection of raised pavement markers:	
	a. Are the markers visible from 90 meters (300 feet) during the daytime?	
	b. Are the markers visible from 48 meters (160 feet), under low-beam headlights, during nighttime?	<u> </u>
7.	During the drive-through inspection of flexible-reflective marker tabs:	
	a. Are the marker tabs visible from 60 meters (200 feet) during the daytime?	
	b. Are the marker tabs visible from 48 meters (160 feet), under low-beam headlights during nighttime?	
8.	Are raised pavement markers in acceptable condition?	···········
	For questions answered NO, state the question number and problem:	
		
	State the action resulting from questions answered NO:	
	me and date that the problem was resolved:	

Module IX.D. Delineators

INSTRUCTION SUMMARY

Duration:

5 minutes

Objective:

To educate students on the inspection techniques for delineators

Content:

TCP Compliance, Locations, Patterns, Cycle Lengths, Colors, Day/Night Inspection,

Visibility Distance, Delineator Quality

Equipment:

Overhead Projector

Aids:

5 Overheads

PRESENTATION OPTIONS

The lesson plan for this module was developed with the assumption that Module IX.A., Module IX.B., and Module IX.C. would be taught immediately preceding this module. Since many of the inspection items are redundant with Module IX.A., they are only touched on briefly here. If, for some reason, the requesting agency wishes a presentation on this topic, but not for standard pavement markings, many of the Module IX.A. overheads could be used for this module to teach it in greater detail.

The participant's notebook information was developed from information in the new Part VI of the MUTCD, the "Roadside Design Guide," along with material from the Texas DOT's "Inspector's Training Manual." Some agencies may publish specific duties of inspectors that can be substituted. If nothing specific to the agency is available, question participants about how their agency is different. Standards for device quality were obtained from ATSSA literature. If discrepancies exist between a specific agency's policy and the standards from the MUTCD, this should be acknowledged with an additional admonition that most agencies will eventually adopt the new Manual.

LESSON PLAN

Introduction

- Delineators are covered in Module IX.D. of the Participant's Notebook.
- Not often used as a work zone device, but they may often occur as existing devices on newly installed work zones.

OV9D-1 - DELINEATORS

- Delineators are devices generally post-mounted at the side of the roadway.
- Their function is to indicate overall roadway alignment information to supplement the more immediate pavement marking and RPM alignment information.
- Typically, they are a small retroreflective button or bit of sheeting mounted on a post.
- Size

OV9D-2 - INSPECTION ITEMS

- TCP Compliance.
- Check colors slightly different than pavement markings; yellow not usually used on left side of divided roadways; usually on only left side of one-way streets or ramps.

OV9D-3 - DELINEATOR DIMENSIONS

- The dimensions given are MUTCD requirements.

OV9D-4 - DELINEATOR SPACING AND VISIBILITY DISTANCE

- Spacing guidelines are approximate; a nighttime drive-through inspection must be done to ensure that the delineators fulfill their intended function of indicating roadway alignment to drivers.
- Visibility distance given is also a MUTCD requirement.

OV9D-5 - DEVICE QUALITY STANDARDS

- ATSSA Guide doesn't contain standards for delineators, since they are seldom used as work zone traffic control devices.
- Standards given here are recommendations loosely based on RPM standards, modified to provide for reasonable gaps in delineator spacing.

VISUAL AIDS

OV9D-1 - DELINEATORS

- Post-mounted
- Installed at side of roadway in series
- Indicate overall roadway alignment
- Typical configuration
 - Metal or plastic shaft embedded in ground

Small retroreflective button or bit of high-intensity sheeting

OV9D-2 - INSPECTION ITEMS

- TCP Compliance
 - Location
 - Number
 - Placement
- Colors
 - White right side of roadway
 - Yellow left side of one-way streets or ramps

OV9D-3 - DELINEATOR DIMENSIONS

- Do the retroreflective elements have a minimum dimension of approximately 75 millimeters (3 inches)?
- Are the retroreflective elements installed a minimum of 1200 millimeters (48 inches) above the level of the roadway?

OV9D-4 - DELINEATOR SPACING AND VISIBILITY DISTANCE

- Is the longitudinal spacing of delineators 30 to 60 meters (100 to 200 feet) on tangent sections and 5 to 25 meters (20 to 90 feet) on curved sections?
- During the drive-through inspection of delineators, are they visible from a distance of 300 meters (1,000 feet) when illuminated by the upper beam of the headlights?

OV9D-5 - DEVICE QUALITY STANDARDS

- Are delineators in acceptable condition?
 - Acceptable
 - All delineators in place and meeting specifications.
 - Marginal
 - Ten percent delineators missing or not visible.
 - No more than one consecutive delineator is missing or not visible.

Unacceptable

- Exceeding number of missing or not visible specified as "Marginal."

Module IX.D. Delineators

Participant's Notebook Text INTRODUCTION

Visual Aids

Delineators are light-retroreflecting devices mounted at the side of the roadway in series to indicate roadway alignment. They normally consist of a plastic or metal shaft and a small retroreflective button or piece of sheeting to provide night visibility.

OV9D-1 Delineators

Prior to delineator installation, is it the type of delineator specified in the TCP or Specifications?

OV9D-2 Inspection Items

Drive through the work zone. Are the locations, patterns, and spacing of markers installed according to the TCP?

For inspections prior to delineator installation, check to ensure that the delineators being used are the same as specified in the TCP or specifications.

Drive through the work zone to inspect the delineators. Check to ensure that the locations and patterns of delineators installed match the TCP specifications. In particular, check to ensure placement and spacing of the delineators are correct according to the TCP.

Are delineators applied according to the TCP, matching the color of the edgeline the delineator is supplementing (i.e., white delineators mark the right side of the roadway and yellow delineators mark the left side of one-way streets and divided roadways)?

When performing the drive-through inspection of the work zone, check to ensure that the:

- White delineators are placed along the right side of the roadway.
- Yellow delineators are placed along the left side of one-way streets and divided roadways.

Are the delineators the same color (white appears white and yellow appears yellow) during the day and night?

Also, drive through the work zone at night to ensure that white and yellow delineators both appear to be the same color day and night. This is necessary because it is possible for pavement delineators to appear to be acceptable during the day,

while their reflective elements may be inadequate to appear the same color at night, and may therefore not provide sufficient information for motorists.

Do the retroreflective elements have a minimum dimension of approximately 75 millimeters (3 inches)?

Are the retroreflective elements installed a minimum of 1200 millimeters (48 inches) above the level of the roadway?

OV9D-3 Delineator Dimensions

The retroreflective elements in delineators must have a minimum dimension of approximately 75 millimeters (3 inches). In addition, check to ensure that their installation places them a minimum of 1200 millimeters (48 inches) above the level of the roadway.

Is the longitudinal spacing of delineators 30 to 60 meters (100 to 200 feet) on tangent sections, and 5 to 25 meters (20 to 90 feet) on curved sections? During the drive-through inspection of delineators, are they visible from a distance of 300 meters (1,000 feet) when illuminated by the upper beam of the headlights?

OV9D-4 Delineator Spacing and Visibility Distance

The longitudinal spacing of delineators should be approximately 30 to 60 meters (100 to 200 feet) on tangent sections and 5 to 25 meters (20 to 90 feet) on curved sections.

Drive-through the work zone at night and inspect the delineators. They should be visible from a distance of 300 meters (1,000 feet) when illuminated by the upper beam of the headlights.

Are delineators in acceptable condition?

OV9D-5 Device Quality Standards

Refer to the following definitions of acceptable, marginal, and unacceptable quality levels for delineators:

- Acceptable: All delineators required are in place and meet all material specifications.
- Marginal: No more than 10 percent of the total number of delineators or no more than one consecutive delineator is missing (or not visible from the specified distance).
- Unacceptable: More than 10 percent of the total number of delineators or two or more consecutive delineators are missing (or not visible from the specified distance).

INSPECTION CHECKLIST -- Delineators

Date Inspected:/_/ Inspector: Location of Device:	
Mile Post and Roadway or Job Number	
Any questions answered NO should be discussed with supervisor.	YES N
1. Prior to delineator installation, is the type of delineator that which is specifing the TCP or Specifications?	fied
2. Drive through the work zone. Are the locations, patterns, and spacing of markers installed according to the TCP?	
3. Are delineators applied according to the TCP, matching the color of the edgeline the delineator is supplementing:	
 a. White delineators - marking the right side of the roadway? b. Yellow delineators - marking the left side of one-way streets and dividence of the roadway? 	ed
roadways? 4. Are the delineators the same color (white appears white and yellow appear yellow) during the day and night?	rs
5. Do the retroreflective elements have a minimum dimension of approximat 75 millimeters (3 inches)?	
6. Are the retroreflective elements installed a minimum of 1200 millimeters (inches) above the level of the roadway?	(48
7. Is the longitudinal spacing of delineators: a. 60 to 90 meters (100 to 200 feet) on tangent sections?	
 b. 5 to 25 meters (20 to 90 feet) on curved sections? 8. During the drive-through inspection of delineators, are they visible from a distance of 300 meters (1,000 feet) when illuminated by the upper beam of headlights? 	
9. Are delineators in "acceptable" condition?	
For questions answered NO, state the question number and problem:	
State the action resulting from questions answered NO:	
Time and date that the problem was resolved:	

X.A. Warning Lights

INSTRUCTION SUMMARY

Duration:

10 minutes

Objective:

To describe points that should be covered when inspecting warning lights

Content:

TCP Compliance, Flashing and Steady-Burn Warning Lights, Lenses, Colors,

Mounting Height, Visibility Distance, Device Quality Standards

Equipment:

Slide Projector

Aids:

12 Slides

PRESENTATION OPTIONS

The participant's notebook information was developed from the information in the new Part VI of the MUTCD, along with standards for device quality obtained from ATSSA literature. Some agencies may publish specific duties of inspectors that can be substituted. If nothing specific to the agency is available, question participants about how their agency is different. If discrepancies exist between a specific agency's policy and the standards from the MUTCD, this should be acknowledged with an additional admonition that most agencies will eventually adopt the new Manual.

LESSON PLAN

SL10A-1 Close up view of a warning light

Warning lights are portable, lens directed, enclosed yellow lights.

SL10A-2 Rear view of warning light on post and battery below

They operate by batteries or self-contained electric power units in either flashing or steady-burning modes.

SL10A-3 Two lines of vertical panels with warning lights

Check to ensure that the warning lights are placed as shown in the contract plans.

SL10A-4 Two barricades with warning lights

Type A low-intensity flashing warning lights are most commonly mounted on

barricades, drums, vertical panels, ...

SL10A-5 Regulatory sign with a warning light

... or advance signs. They are intended to warn drivers that they are approaching or in a hazardous area.

SL10A-6 Type III barricade with two warning lights

Type B high-intensity flashing warning lights are normally mounted on advance warning signs or on independent supports. They are intended to operate 24 hours per day and are intended to mark extremely hazardous site conditions.

Neither Type A nor Type B flashing warning lights are intended for delineation.

SL10A-7 Warning lights on a run of barrier

Type C steady-burn lights are intended to be used to delineate the edge of the traveled way on detour curves,...

SL10A-8 Warning lights on drums in a taper

... lane changes, on lane closures, and on other similar situations.

SL10A-9 Drum with warning light

The yellow lights should be completely within the lens and should be mounted a minimum of 30 inches above the ground.

SL10A-10 Barricade with a warning light turned sideways

The lenses should be clean and in good condition and not cracked, broken, or misaligned.

SL10A-11 Vertical panels with warning lights

Type A low-intensity and Type C steady-burning lights should be visible from at least 900 meters (3,000) feet during clear, nighttime conditions.

SL10A-12 Type III barricade, large arrow sign and warning lights

Type B high-intensity flashing warning lights should be inspected during the day and

should be visible from a distance of 300 meters (1,000 feet).

That was a description of the three types of warning lights: Type A low-intensity flashing, Type B high-intensity flashing, and Type C, steady-burning warning lights.

The key to inspecting warning lights is to know which type of warning light is specified in the traffic control plan and specifications.

Review the inspection checklist for Module X.A. Warning Lights.

VISUAL AIDS

SL10A-1	Close-up view of a warning light
SL10A-2	Rear view of warning light on post and battery below
SL10A-3	Two lines of vertical panels with warning lights
SL10A-4	Two barricades with warning lights
SL10A-5	Regulatory sign with a warning light
SL10A-6	Type III barricade with two warning lights
SL10A-7	Warning lights on a run of barrier
SL10A-8	Warning lights on drums in a taper
SL10A-9	Drum with warning light
SL10A-10	Barricade with a warning light turned sideways
SL10A-11	Vertical panels with warning lights
SL10A-12	Type III barricade, large arrow sign, and warning lights

Module X.A. Warning Lights

Participant's Notebook Text INTRODUCTION

Warning lights are portable, lens-directed, enclosed yellow lights that operate by batteries or self-contained electric or solar power units in either flashing or steady-burning modes. Flashing lights are used to mark obstructions or hazards because they are generally better at attracting the driver's attention. When lights are used to show the way through and around obstructions in a work zone, steady-burn lights must be used. This is because a series of flashing lights around a curve can obscure the desired vehicle path and confuse drivers.

Are the lights placed as shown in the plans?
Are the proper warning lights present as shown on the TCP?
Are all lights used for delineation of the proper travel path steady-burn (not flashing) type warning lights?

Check to ensure that the warning lights are placed as shown in the contract plans. There should be the proper number, type, and arrangement of warning lights, as shown in the TCP. All lights used for delineation of the proper travel path should be steady-burn warning lights. This includes lights on curves, tapers, crossovers, and other similar situations. By contrast, lights used singularly to mark a hazard should be flashing warning lights.

Are the lights completely enclosed within the lens? Is the light emitted yellow in color?

Are the better of the lights mounted at least 750 mi

Are the bottom of the lights mounted at least 750 millimeters (30 inches) off the ground?

Are the lenses relatively clean and in good condition?

Check to ensure that the lights are completely enclosed within the lens. The lens shall be mounted a minimum of 750 millimeters (30 inches) above the ground, and the light emitted from the lens should be yellow in color. The lenses on the warning lights should be relatively clean, in good condition, and not cracked or broken.

Are all Type A and Type C warning lights visible from at least 900 meters (3,000 feet) during clear, nighttime conditions?

Are all Type B warning lights visible from at least 300 meters (1,000 feet) during sunny, daylight conditions when the light is viewed so that the sun is not directly behind the warning light?

Visual Aids

SL10A-1 Closeup view of a warning light

SL10A-2 Rear view of a warning light on post and battery below

SL10A-3 Two lines of vertical panels with warning lights

SL10A-4 Two barricades with warning lights

SL10A-5 Regulatory sign with a warning light

SL10A-6 Type III barricade with two warning lights

SL10A-7 Warning lights on a run of barrier

SL10A-8 Warning lights on drums in a taper

SL10A-9 Drum with warning light

SL10A-10 Barricade with a warning light turned sideways

SL10A-11 Vertical panels with warning lights

SL10A-12 Type III barricade, large arrow sign and warning lights

Type A (flashing) and Type C (steady burning) warning lights should be visible from at least 900 meters (3,000 feet) during clear, nighttime conditions.

Type B warning lights (flashing high intensity) warning lights should be inspected during the day. As long as the sun is not directly behind the warning lights, the lights should be easily visible for a distance of at least 300 meters (1,000 feet) during sunny, daylight conditions.

Are the warning lights in acceptable condition?

Refer to the following descriptions of acceptable, marginal, and unacceptable warning lights for inspection:

- Acceptable: More than 90 percent of the Type A or C and 100 percent of the Type B lights meet the criteria for visibility distance.
- Marginal: Not less than 90 percent of the Type A or C warning lights meeting the visibility distance criteria, with no more than three adjacent lights failing.
- Unacceptable: Less than 90 percent of the Type A or C warning lights meet the visibility distance criteria, or more than three adjacent lights are failing, or more than one Type B warning light failing for more than 12 consecutive hours, unless otherwise specified in the contract documents.

INSPECTION CHECKLIST -- Warning Lights

Date	Inspected: _// Inspector:	
Loca	ation of Device:	
	Mile Post and Roadway or Job Number	
Any	questions answered NO should be discussed with supervisor. YES N	10
1.	Are the lights placed as shown in the plans?	
2,	Are the proper warning lights present as shown on the TCP?	
3.	Are all lights used for delineation of the proper travel path steady-burn (not flashing) type warning lights?	
4.	Are the lights completely enclosed within the lens?	,
5.	Is the light emitted yellow in color?	
6.	Are the bottom of the lights mounted at least 750 millimeters (30 inches) off the ground?	
7.	Are the lenses relatively clean and in good condition?	
8.	Are all Type A and Type C warning lights visible from at least 900 meters (3,000 feet) during clear, nighttime conditions?	
9.	Are all Type B warning lights visible from at least 300 meters (1,000 feet) during sunny, daylight conditions so long as the light is viewed so that the sun is not directly behind the warning light?	
10.	Are the warning lights in acceptable condition?	
	For questions answered NO, state the question number and problem:	
	State the action resulting from questions answered NO:	
	e and date that the problem was resolved:	
Sign	nature and Title:	

X.B. Floodlights

INSTRUCTION SUMMARY

Duration:

5 minutes

Objective:

To describe points that should be covered when inspecting floodlights

Content:

TCP Compliance, Floodlight Aiming, Condition, and Safety

Equipment:

Slide Projector

Aids:

1 Slide

PRESENTATION OPTIONS

The participant's notebook information was developed from the information in the new Part VI of the MUTCD, along with standards for device quality obtained from ATSSA literature. Some agencies may publish specific duties of inspectors that can be substituted. If nothing specific to the agency is available, question participants about how their agency is different. If discrepancies exist between a specific agency's policy and the standards from the MUTCD. This should be acknowledged with an additional admonition that most agencies will eventually adopt the new Manual.

LESSON PLAN

The trend these days is to conduct more work at night when traffic is lighter. The use of floodlights is imperative. Unfortunately, there are very few guidelines on the best usage of floodlights, although research is presently being conducted.

SL10B-1 Picture of a floodlight

Floodlights are used at nighttime to illuminate flagger stations, equipment crossings, and night paving operations as was shown in the nighttime traffic control video.

Check the plans and specifications for number and usage of floodlights.

Drive past the work space in both directions. The most important safety item for floodlights is that they do not cause excessive glare or blind motorists. Check that the floodlights illuminate the work space, but do not shine in drivers' eyes.

Observe the work operation in progress and ensure that the floodlights provide adequate

illumination for the workers to perform their jobs safely.

Check to determine if the floodlights are in good condition and do not present any electrical hazards.

(Review the inspection checklist for Module X.B. Floodlight for inspection requirements.)

VISUAL AIDS

SL10B-1 Picture of a floodlight

Module X.B. Floodlights

Participant's Notebook Text INTRODUCTION

As daytime work grows more hazardous due to congestion, nighttime work becomes increasingly common. When nighttime work is required to perform a job, floodlights are often used to illuminate flagger stations, equipment crossings, and other areas where existing light is not adequate for the work to be performed satisfactorily.

Are the floodlights aimed so as to avoid glare for oncoming drivers in either direction?

Are the floodlights aimed correctly so as to illuminate the proper work area as shown in the TCP?

Are the proper number of floodlights present as shown in the TCP? Are the floodlights located properly as shown in the TCP?

The first thing to check is that the floodlights do not blind motorists. This is the most important aspect of operating floodlights safely. A drive-through inspection must be performed in both directions to ensure that motorists are shielded from glare that the floodlights might cause. Several items should be checked to ensure that the floodlights installed in the field conform to the specifications of the TCP. The work area that the floodlights are intended to illuminate should be shown in the TCP. Check this area at night to ensure that the floodlights are, in fact, illuminating this area properly, that lights are not burned out, and that they are aimed appropriately. The next thing to check is that the proper number of floodlights are present. Finally, check for the proper location of the floodlights according to the plans.

Are the floodlights in good condition?

Do the floodlights appear safe and free from defects that might present an electrical hazard?

Does the light emitted by the floodlights provide adequate illumination for the workers to perform their jobs safely?

Go into the work zone to look at the floodlights and check that they are in good condition. Also check to see if they appear safe and free from defects that might present an electrical hazard. Finally, observe the work area that is illuminated by the floodlights. Check to see that there is adequate illumination for the workers to perform their jobs safely.

Visual Aids

SL10B-1 Picture of a floodlight

INSPECTION CHECKLIST -- Floodlights

Da	te Inspected:/_/ Inspector:		
Loc	cation of Device: Mile Post and Roadway or Job Number	The second secon	
An	ny questions answered NO should be discussed with supervisor.	YES	NC
1.	Are the floodlights aimed so as to avoid glare for oncoming drivers in either direction?	·	÷
2.	Are the floodlights aimed correctly so as to illuminate the proper work area as shown in the TCP?		
3.	Are the proper number of floodlights present as shown in the TCP?		
4.	Are the floodlights located properly as shown in the TCP?		***************************************
5.	Are the floodlights in good condition?		
6.	Do the floodlights appear safe and free from defects that might present an electrical hazard?	-	
7.	Does the light emitted by the floodlights provide adequate illumination for the workers to perform their jobs safely?		
·	For questions answered NO, state the question number and problem:		
	State the action resulting from questions answered NO:		-
Tiı	me and date that the problem was resolved:		
Sig	gnature and Title:		

Module XI.A. G.R.E.A.T. Construction Zone (GCZ)

INSTRUCTION SUMMARY

Duration:

20 minutes

Objective:

To familiarize participants with inspection techniques for the GCZ.

Content:

Introduction, Definitions, GCZ Parts, Inspection Points, Anchoring, Foundation,

Site Inspection

Equipment:

Slide Projector

Aids:

26 Slides

PRESENTATION OPTIONS

The participant's notebook includes information from the Texas DOT's "Inspector's Training Manual." Some agencies may publish specific duties of inspectors that can be substituted. If nothing specific to the agency is available, question participants about how their agency is different.

LESSON PLAN

Introduction

- The GREAT is section XI.A. of the Participant's Notebook.
- This presentation is on inspection points for the GREAT.
- Note that the GCZ Module of the Notebook is formatted somewhat differently than the other modules.
- Difficulty among inspectors in identifying and becoming familiar with the various parts of the GCZ.
- The first part of this module defines and explains the parts of the GCZ.
- In the classroom presentation, we'll first give a brief introduction to the GCZ, then the material on inspection points will be covered.

SL11A-1 - Photo with overall view of GCZ

- The GREAT CZ is a redirective, non-gating crash cushion designed for use in construction zones.

- Protects occupants of errant vehicles upon impact with roadside objects.
- Employs foam cartridges to absorb energy through telescopic collapsing action of the unit.

SL11A-2 - Orange artwork slide showing labelled parts of GCZ

- The GREAT is a complex mechanical system with many parts.
- It requires a lot of inspection and maintenance to keep it operating properly and safely.

SL11A-3 - Photo of Hex-Foam Cartridge

- We'll now move on to inspection points, starting with the first question in bold on page 11A-4 of your notebook.
- Have all cartridges been inspected and replaced if necessary?
- Look at cartridges for deformity, signs of splitting, or other damage.
- Look for the words "Hex-Foam II" on the cartridge.
- The cartridges must be properly positioned down between the diaphragms and resting securely on the support tabs.

SL11A-4 - Close-up of mushroom bolt and fender panel

- One of the first things to inspect for a GREAT is its general condition
- Are all bolts tight?
 - Tap fender panels with a hammer to check--there should be very little or no rattling.

SL11A-5 - Close-up underneath the GCZ

- Is the unit free from significant rust that could impair its impact performance?
 - Check the components of the GREAT for rust.
 - The parts must be rust free, or they may "lock-up" on impact, creating too rigid an obstacle and possibly causing injuries.

SL11A-6 - Long view of GCZ, showing underside (somewhat)

- Is the area beneath the G-R-E-A-T CZ unit free of debris?
 - Underside of the GREAT should be clear of debris.

- Otherwise, the debris can break connections between the panels and diaphragms.
- Also, check the steel channels at the base of the GREAT.

SL11A-7 - Photo down along the line of the GCZ from behind, taken by backup

- Many individual parts must be inspected on the GREAT.
- Are the diaphragms in good condition and installed so that they are at right angles to the fender panels?
 - These separate the hex-foam cartridges in the GREAT and provide for a smooth collapse of the system.
 - They must be placed properly for the system to work:
 - Perpendicular to the fender panels.
 - Their legs should be placed securely down in the steel channels on the GCZ base.

SL11A-8 - Free-standing diaphragm showing chain pegs and cable guide loops

- Does the chain peg for each diaphragm point toward traffic?
 - Diaphragms must also be placed so that their chain pegs face forward (toward the nose of the unit).

SL11A-9 - Side shot of GCZ showing anchor chains

- Are chains over the peg on every diaphragm?
 - These are installed on each of the diaphragm chain pegs.
 - They must face forward (toward the nose of the unit).
 - These must be checked very regularly and as often as possible, as this is a very common maintenance problem with the GREAT.

SL11A-10 - Close-up of chains showing retaining pins

- Is a retaining pin used to anchor the chain to the platform?
 - On the other end of the chains (at the base of the GCZ), there must be retaining pins installed.
 - Retaining pin clips must be installed in each of the pins.

SL11A-11 - Close-up of front end of cable guide system

- Is the restraining cable properly installed, and does it pass through the cable guides on the first two diaphragms on six-bay units and one diaphragm on three-bay units?
 - This system restrains the upward movement of the GCZ in the event of an impact.
 - This is a very important feature of the GCZ concerning impact performance.
 - By holding the unit down, this keeps cars from "submarining" or diving under the GREAT.
 - The cable guide system must be attached at the front and rear of the GREAT.
 - The cable guide system is only required on GREATs that are larger than three bays.

SL11A-12 - Shot of men installing front end of cable guide system

- Cable guide system
 - At the front of the GREAT, the cable must pass through the cable guide loops in the first two diaphragms of the system (for GREATs larger than three bays).

SL11A-13 - Shot of man's hand installing cable guide end

- Cable guide system
 - The threaded cable end must pass through the hole in the front mounting bracket.

SL11A-14 - Shot of man's hand screwing on large bolt at end of threaded cable

- Cable guide system
 - Square steel end plate washers can be inserted to keep the cable taut, and the end cap bolt must be screwed on.

SL11A-15 - Shot of rear guide system, with man installing U-bracket and pass-through pin

- Cable guide system
 - At the rear of the unit.
 - The cable is attached to the bracket with the bolt and retaining cotter pin.

SL11A-16 - Long view of GCZ, showing cable guide system underneath

- Is the restraining cable tight?
 - The cable guide system must be taut for proper impact performance.
 - Look for sag in the cable -- if there is sag, the system must be tightened.
 - The cable can be tightened by tightening the threaded end cap bolt at the front end, or adding square steel washers at the front bracket connection.

SL11A-17 - Slide of GCZ - medium shot

- Are the fender panels free from any unnecessary bolts or other objects obstructing their movement?
 - Check for obstructions to rearward movement.
- Are diaphragm shoes free to slide?
- Do all fender panels, except those on the sides of the last bay, have deflector clips attached to the rear outside surface with the angled portion turned outward toward traffic?
 - Check that every panel, except for the one nearest the backup, has a deflector clip installed.
 - The clips must point toward the rear of the unit, away from the center of the GREAT.
 - The clips prevent snagging of the fender panels as the GREAT collapses.

SL11A-18 - Close-up on mushroom bolts

- Are mushroom bolt assemblies installed properly?
 - These tie the fender panels together.
 - They pass through slots in each two adjoining fender panels.
 - This allows backward slide, or telescoping, as the GREAT collapses rearward in an impact.
 - Proper installation includes:
 - Near back of long slotted hole; long axis in horizontal direction.
 - Bolt head flush with mushroom washer surface.

Edges conforming to w-beam, and bolts properly torqued.

SL11A-19 - Orange artwork slide; diagram of mushroom bolt assembly

Mushroom bolts

- Attached as shown in the slide.
- Installed on all but the rear fender panel on either side of the GREAT.

SL11A-20 - Medium shot of bi-directional transition plate attached to concrete barrier terminal

- Is the transition panel at the rear of the unit in place for bi-directional traffic situations?
 - Installed at rear of GREAT (away from nose).
 - Connected to the last fender panel on the traffic side and to the backup.
 - Purpose is to prevent cars impacting in the opposite direction from the intended impact direction from snagging on the rear of the unit.

SL11A-21 - Long shot of Bi-directional plate at two-way traffic location

- Bi-directional transition plate
 - Must be installed when GREAT has traffic passing in the opposite direction.
 - The slide illustrates where the transition plates must be installed; explain how this concept is implemented.

SL11A-22 - Medium shot of GCZ

- Are all parts used in the GCZ the proper manufacturer-supplied parts?

SL11A-23 - Shot of man's hand drilling anchor holes

- Is the GCZ properly anchored with 22 anchors for the six-bay system, 16 anchors for the 3-bay system?
 - It is more important to note what type of surface the GREAT is installed on and to then ensure that the anchoring system used is of the proper type for that foundation material.
 - For the six-bay GREAT, check for 22 anchors installed.
 - For the three-bay GREAT, only 16 anchors are required.

SL11A-24 - Medium shot of GCZ

- Are anchors secured, with surrounding pavement in good condition?
 - The type of anchors used is determined by the surface on which the GREAT is installed.
 - On most surfaces, the anchors are 3/4-inch-diameter threaded rods, 18 inches in length.
 - For asphalt with compacted soil sub-base, the anchoring system may consist of an anchor pin bracket fastened to an anchor pin with a 3/4-inch-diameter hex head bolt, 1 ½ inches in length, with a nut and a washer. The anchor pin bracket must then be attached to the platform foot pad.

SL11A-25 - Shot of men at nose of GCZ, standing on base pad

- Is the GCZ installed either on a level asphalt or concrete pad, in good condition, or, failing this, is the DPA system employed?
 - Type of foundation under the GREAT is important.
 - The Participant's Notebook has a table of acceptable foundation depths on a variety of surfaces.
 - In practice, it is difficult to check how deep each layer of foundation material may be.

SL11A-26 - Long shot of overall GCZ site

- Is the GCZ installed at a site where vehicles can cleanly impact the unit without interference from other objects?
 - Obstacles can cause ramping over GCZ
- Is the site where the GCZ is located level, with no curbs or islands underneath the unit?
 - Slope shouldn't exceed 8 percent or 1 inch of vertical drop per 1 foot of horizontal displacement.
- Does the GCZ have an adequate number of bays for the design speed at the site (6 bays for speeds > 60 kilometers per hour (40 miles per hour), 3 bays for speeds < 60 kilometers per hour (40 miles per hour))?
 - Proper number of bays critical for proper impact performance at a site.

VISUAL AIDS

- SL11A-1 Photo with overall view of GCZ
- SL11A-2 Orange artwork slide showing labelled parts of GCZ
- SL11A-3 Photo of Hex-Foam Cartridge
- SL11A-4 Close-up of mushroom bolt and fender panel
- SL11A-5 Close-up underneath the GCZ
- SL11A-6 Long view of GCZ, showing underside (somewhat)
- SL11A-7 Photo down along the line of the GCZ from behind, taken by backup
- SL11A-8 Free-standing diaphragm showing chain pegs and cable guide loops
- SL11A-9 Side shot of GCZ showing anchor chains
- SL11A-10 Close-up of chains, showing retaining pins
- SL11A-11 Close-up of front end of cable guide system
- SL11A-12 Shot of men installing front end of cable guide system
- SL11A-13 Shot of man's hand installing cable guide end
- SL11A-14 Shot of man's hand screwing on large bolt at end of threaded cable
- SL11A-15 Shot of rear guide system, with man installing U-bracket and pass-through pin
- SL11A-16 Long view of GCZ, showing cable guide system underneath
- SL11A-17 Slide of GCZ medium shot
- SL11A-18 Close-up on mushroom bolts
- SL11A-19 Orange artwork slide; diagram of mushroom bolt assembly

SL11A-20 - Medium shot of Bi-directional transition plate attached to concrete barrier terminal

SL11A-21 - Long shot of Bi-directional plate at two-way traffic location

SL11A-22 - Medium shot of GCZ

SL11A-23 - Shot of man's hand drilling anchor holes

SL11A-24 - Medium shot of GCZ

SL11A-25 - Shot of men at nose of GCZ, standing on base pad

SL11A-26 - Long shot of overall GCZ site

Module XI.A. G.R.E.A.T. Construction Zone (GCZ)

Participant's Notebook Text INTRODUCTION

Visual Aids

The GCZ is a redirective crash cushion designed to protect narrow hazards in work zones or wherever temporary protection is needed. The purpose of the GCZ is to protect errant motorists from harm upon collision with fixed roadway or roadside objects. The system consists of crushable Hex-Foam cartridges surrounded by a framework of corrugated steel guardrail.

SL11A-1 Photo with overall view of GCZ

This section is formatted slightly differently than the other modules of this notebook. There has long been some difficulty among inspectors in identifying and becoming familiar with the various parts of the GCZ. For this reason, the first part of this module will define and explain the parts of the GCZ in some detail, then the material on inspection points will be covered.

DEFINITIONS

The GCZ System comes in two standard lengths, including a three-bay system and a six-bay system. Each bay contains a crushable cartridge. Therefore, the larger number of bays gives the GCZ a greater energy-absorbing capacity. These two systems are designed to provide different levels of protection; the larger, six-bay system is used for higher speed applications, while the three-bay GCZ can be used when the speeds will be lower. The GCZ also offers two standard widths: 600 millimeters (24 inches) and 750 millimeters (30 inches).

SL11A-2 Orange artwork slide showing labelled parts of GCZ

Figure 11A-1 contains a depiction of the GCZ with the various parts labelled. Note that the six-bay GCZ actually contains seven hex-foam cartridges, including the cartridge in the nose section. This can be a point of possible confusion. These various parts of the GCZ are discussed in more detail below.

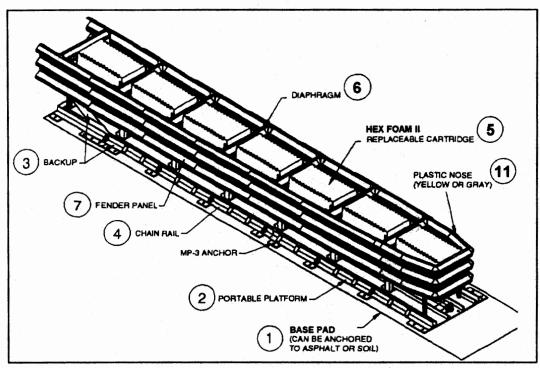


Figure 11A-1. G-R-E-A-T CZ illustration of parts.

1. Base Pad

The GCZ is designed to rest on a concrete pad, asphalt, or soil. Depending on the type of GCZ installed, which type of pad is used, and the base and sub-base material, different thicknesses are required for the base pad.

2. Portable Platform

The GCZ hardware rests on a one-piece platform that sits atop the concrete pad (or other anchoring system) as described in 1 above. The Portable Platform includes the backup for the system.

3. Backup

The GCZ's backup is built into the tension struts on the portable platform. The purpose of the backup is to act as a supporting "wall" behind the GCZ, adding stability and resistance to the deformation of the Hex-Foam cartridges in an accident.

4. Chain Rails

The platform also includes the chain rails, which serve as an anchor for the restraining chains attached to each diaphragm. The restraining chains are pinned to the rails on the platform and looped over pegs on the feet to provide stability when impacted from the side.

5. Hex-Foam II Cartridge

The hex-foam cartridge is the energy-absorbing component of the GCZ. Hex-foam is a honeycomb matrix of hexagon-shaped cells filled with polyurethane foam. Each hex-foam cartridge consists of a stabilizing metal honeycomb core surrounded by standard hex foam. The cartridge shell is made of polyethylene plastic.

6. Diaphragms

A diaphragm separates each hex-foam cartridge in the GCZ. The hex-foam cartridges are supported by the diaphragms on the diaphragm brackets. The diaphragms are made of thrie-beam guardrail and supported on two support legs. The support legs fit into the steel C-channel on the platform at the base of the unit. The bottom of the support legs is equipped with flared ends to accommodate backwards sliding during an impact with the unit. The first two diaphragms have holes for the restraining cable to pass through.

7. Fender Panels

The fender panels are simple sections of guardrail that run along the sides of the GCZ. The fender panels are attached to and supported by the diaphragms between each hex-foam cartridge. During an impact, the diaphragms slide backwards, and the fender panels telescope to allow this backwards motion.

8. Mushroom Deflectors

The mushroom deflectors are bolted to the GCZ's fender panels. When the fender panels telescope during an impact, the mushroom deflectors prevent each fender panel from snagging on the mushroom bolt of the panel behind it. Mushroom deflectors are not attached to the last fender panel (near the backup).

9. Restraining Cable Guides

The restraining cable guides are attached to the two front diaphragms (closest to the nose). These guides are attached to the underside of each diaphragm's cross-bar. The restraining cable is threaded through these guides.

10. Restraining Cable

The restraining cable is attached to the front anchor and threaded through guides in the first two diaphragms (at the nose). It is also attached to the rear anchor and tensioned to 200 newton-meters (150 foot-pounds). This cable provides stability and prevents the system from shifting when impacted from the side. It also prevents the system from being lifted up by a vehicle during a head-on impact.

11. Nose

The nose of the system is made of pliable plastic. It is attached to the front diaphragm and rests on two support legs.

You should now be familiar with all of the basic parts of the GCZ. The next section discusses how to go about inspecting the GCZ in greater detail.

Have all cartridges been inspected and replaced as necessary?

Check to see if the Hex-Foam II cartridges are in good shape and the bottom "lids" are adequately held in place around their perimeters. No staples can be missing.

All cartridges in the GCZ should be labeled "Hex-Foam II". Check to ensure the cartridges are properly positioned in each bay, plus the nose of the unit. Proper position for the cartridges is centered lengthwise and laterally in the bay and resting securely on the lower support tabs.

Are all bolts tight?

All the bolts in the GCZ should be tight. A loose bolt can create unusually extensive repair needs following an impact. A good test is to tap the fender panels lightly with a hammer. A rattle indicates one or more loose bolts that should be tightened.

Is the unit free from significant rust that could impair its impact performance?

The GCZ's parts should be free of any rust. This is particularly important to check on the steel C-channels at the base of the unit and the diaphragm legs. Rust in these areas could cause the GCZ to "lock up" on impact, preventing the backward collapsing action of the unit and greatly increasing the likelihood of injury to persons in the impacting vehicle.

SL11A-3 Photo of Hex-Foam Cartridge

SL11A-4 Close-up of mushroom bolt and fender panel

SL11A-5 Close-up underneath the GCZ

Is the area beneath the G-R-E-A-T CZ unit free of debris (bottles, rocks, cans, etc.)?

SL11A-6 Long view of GCZ, showing underside (somewhat)

Rocks, cans, bottles, or other debris under the GCZ system can cause the diaphragms to be accelerated upward as they slide to the rear of the unit. They may also prevent the proper collapsing action of the unit. If the unit does not collapse correctly, the connections between the diaphragms and the side panels can break, warping the diaphragm. Therefore, check to ensure that the area underneath the GCZ is clean.

Are the diaphragms in good condition and installed so that they are at right angles to the fender panels? Does the chain peg for each diaphragm point toward traffic?

SL11A-7 Photo down along the line of the GCZ from behind, taken by backup

Ensure that the diaphragms are in good condition. Also, the GCZ fender panels must always be at right angles to the diaphragms. Impacts from the opposite direction sometimes ride up on the crash cushion and push the diaphragms out of position. While the system appears to be functional, it may lock up on frontal impact. Certainly, the damage to interior hardware of the GCZ will be substantially greater than if the diaphragms are correctly positioned when impact occurs.

Also, it is important to ensure that the diaphragms are oriented properly. The diaphragms should be set in the channels with the inner portion of the thriebeam section facing forward, as shown in figure 11A-2. If the diaphragms are installed backwards, the chain peg will point toward the back of the system rather than the front. In this event, the anchor chain cannot slide off the peg during the backward movement of the system. This causes an extremely unsafe installation.

SL11A-8 Free-standing diaphragm, showing chain pegs and cable guide loops

Are chains over the peg on every diaphragm? Is a retaining pin used to anchor the chain to the platform?

SL11A-9 Side shot of GCZ showing anchor chains

The anchor chains provide lateral stability to restrain the GCZ in the event of a side impact. The anchor chains must be installed securely at the base of the unit and installed properly over the chain pegs on the legs of the diaphragms. Check to ensure that the chains are anchored to the platform with 5/8" diameter retaining pins and retaining pin clips. Check to ensure that all of the chains are hooked over the chain pegs and pointing towards the nose of the unit, as shown in figure 11A-3. The chains must be checked on a regular basis, as this is a very common maintenance problem.

SL11A-10 Close-up of chains, showing retaining pins

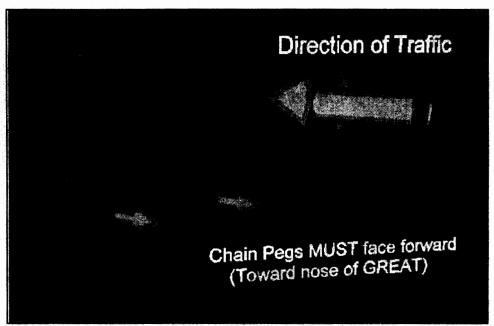


Figure 11A-2. Proper diaphragm orientation.

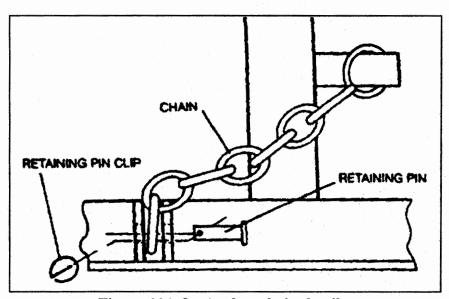


Figure 11A-3. Anchor chain details.

Is the restraining cable properly installed, and does it pass through the cable guides on the first two diaphragms on six-bay units and one diaphragm on three-bay units?

SL11A-11 Close-up of front end of cable guide system

Several problems typically occur with in-place condition of the cable guide system on the GCZ. The purpose of this cable system is to restrain the upward movement of the GCZ during impact. If the cable is not properly installed, this may not occur, and could cause a car to vault or dive under the GCZ system. In this case, the system will not be able to bring the errant vehicle to a controlled stop, and injuries to the motorist and others may occur.

SL11A-12 Shot of men installing front end of cable guide system

One common problem with the cabling system is improper installation. The cable should be attached securely at the front and back of the GCZ with a bracket, anchor, and cotter pin, as shown in figure 11A-4.

SL11A-13 Shot of man's hand installing cable guide end

SL11A-14 Shot of man's hand screwing on large bolt at end of threaded cable

SL11A-15 Shot of rear guide system, with man installing U-bracket and pass-through pin

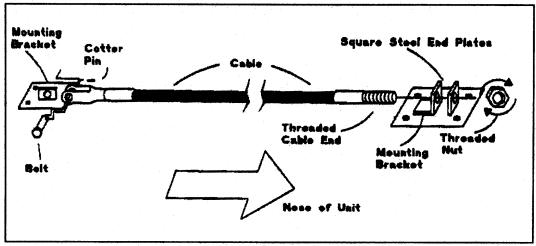


Figure 11A-4. Cable guide system anchoring.

Another common problem with the cabling system actually occurs during installation of the diaphragms. Often, the cable guide brackets are not attached to the first two diaphragms. Only one diaphragm needs a bracket on a 3-bay GCZ. If these are missing, there are no brackets available on the first diaphragm(s) for the cable to pass through. You must be certain that the cable passes through the hole in the metal plate attached to the bottom of the first two diaphragms. (Only one diaphragm needs to have the cable passing through it on the three-bay GCZ.)

4Is the restraining cable tight? (Note: Not required for 3-bay units.)

SL11A-16 Long view of GCZ, showing cable guide system underneath

Another problem may occur with the adjustment of the cable system. In order to function properly, the cable must be taut. The restraining cable must be attached to the front and rear restraining cable anchors. Also, the cable nut should have been torqued to approximately 200 newton-meters (150 foot-pounds) and the cable should therefore be very taut. Any noticeable sag, especially near the rear of the GCZ, indicates a need to tighten the cable.

SL11A-17 Slide of GCZ - medium shot

Are the fender panels free from any unnecessary bolts or other objects obstructing their movement?

Are diaphragm shoes free to slide?

The action of the GCZ requires the fender panels to slide backward on frontal impact. On occasion, other objects restrict the movement. This is particularly true with the last panel when the backup is a Concrete Terminal Barrier. Check both sides to be certain that the fender panels do not have bolts, brackets, sign supports, or other elements that might restrict their rearward motion.

Do all fender panels except those on the sides of the last bay have deflector clips attached to the rear outside surface with the angled portion turned outward toward traffic?

Every fender panel except the last panel (nearest the backup) should have a deflector clip to prevent the fender panel edges from snagging as they slide to the rear. This clip goes at the rear edge of the panel; the angled portion should point rearward toward the outside of the crash cushion.

Are mushroom bolt assemblies installed properly? Are they near back of long slotted hole with their long axis in horizontal direction, and is the bolt head flush with mushroom washer surface. Do the edges conform to the w-beam, and are the bolts properly torqued?

The mushroom bolt washer assembly ties the fender panels together during the collapsing action of the GCZ. It is installed near the back of the long slotted hole and its edges should conform to the shape of the w-beam. The bolt head should be flush with the surface of the mushroom washer assembly. See figure 11A-5.

SL11A-18 Close-up on mushroom bolts

SL11A-19 Orange artwork slide; diagram of mushroom bolt assembly

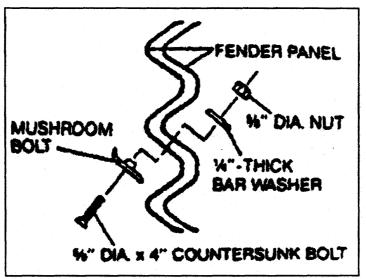


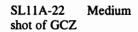
Figure 11A-5. Mushroom bolt assemblies.

Is the transition panel at the rear of the unit in place for bi-directional traffic situations?

If the GCZ is used between two separate traffic streams flowing in opposite directions, check to ensure that a transition panel is installed. The bi-directional transition panel is located at the back of the unit. It must always be in place when two-way traffic is involved. Otherwise, a side hit from the opposing direction may snag on the rear of the unit, causing undesirable deceleration forces on a vehicle. The bi-directional transition plate is installed by connecting it with the last fender panel on the GCZ (nearest the backup), as shown in figure 11A-6.

SL11A-20 Medium shot of bi-directional transition plate attached to concrete barrier terminal

SL11A-21 Long shot of bi-directional plate at two-way traffic location



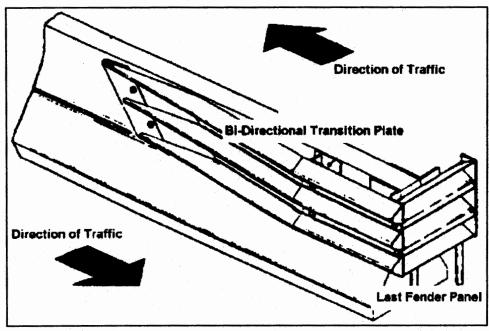


Figure 11A-6. Bi-directional transition plate.

Are all parts used in the GCZ the proper manufacturer-supplied parts?

On occasion, maintenance personnel have purchased bolts locally to replace broken or lost bolts on the GCZ. All bolts in the GCZ are of special, highstrength steel. Replacement of lost or damaged bolts with those purchased locally can result in greater damage when the bolts fail unexpectedly.

Also, "homemade" parts are sometimes substituted for the manufacturer's recommended parts. Such substitutions can cause much additional damage due to unexpected yielding of these elements during an impact. As a very temporary expedient to get the system back up to some degree of utility, substitution may be acceptable. It is understood that when a substitution is made, the proper bolts and/or parts are to be installed as soon as possible.

Is the GCZ properly anchored with 22 anchors for the six-bay system and 16 anchors for the three-bay system?

In order to function properly, the GCZ must be properly anchored. The number of anchors required depends on the length of the GCZ system. For the 6-bay system, ensure that 22 anchors are used, and that they are securely fastened at the base of the GCZ system. For the 3-bay system, only 16 anchors are required.

SL11A-23 Shot of man's hand drilling anchor holes

Are the anchors secured, and is the surrounding pavement in good condition?

SL11A-24 Medium shot of GCZ

In some cases, during an impact, the anchor pins will pull out of the surrounding asphalt. In this case, it is very important to relocate the GCZ unit so that anchor pins can be reset into undisturbed asphalt. Also, if the asphalt is too thick to drive the pins through, a 100 x 100 millimeter (4 x 4 inch) square hole may be chiseled out at each anchor pin location before the pins are installed. Grout or cold patch should then be used around each anchor pin after installation of the pins.

Is the GCZ installed either on a level asphalt or concrete pad, in good condition, or, failing this, is the DPA system employed?

SL11A-25 Shot of men at nose of GCZ, standing on base pad

In general, the GCZ should be installed on an asphalt or concrete pad, with the number of anchors based on the size of the unit. However, a third alternative is available for soil-only foundations. This anchoring system is called the Driveable Pile Anchor (DPA) system. The DPA system is intended for use only with the six-bay GCZ. The system consists of six square steel columns that are driven into the ground. Special hardware is attached to these columns, which are then used as cable anchors.

Is the GCZ installed at a site where vehicles can cleanly impact the unit without interference from other objects?

SL11A-26 Long shot of overall GCZ site

There must be adequate width at the site to allow an impacting vehicle to cleanly impact the GCZ without interference from nearby fixed objects. The GCZ should be installed at a location where there is a fairly clear approach area. That is, the area "in front of" the GCZ (the direction from which impacting vehicles will be approaching) should be free of obstacles or geometric features that would cause an errant vehicle to "ramp" over the GCZ or otherwise prevent a clean impact on the front of the GCZ. Ensure that the hazard is properly shielded behind the unit and not protruding beyond the sides.

Is the site where the GCZ is located level, with no curbs or islands underneath the unit?

The base of the unit should be located flush with the road grade level, and there should be no elevated curbs or islands underneath the GCZ unit. The lateral cross slope under the unit should not exceed 8 percent, or 25 millimeters (1 inch) of vertical drop per 0.3 meters (1 foot) of horizontal displacement.

Does the GCZ have an adequate number of bays for the design speed at the site (6 bays for speeds > 60 kilometers per hour (40 miles per hour), 3 bays for speeds < 60 kilometers per hour (40 miles per hour))?

Ensure that an adequate number of bays are installed for the design speed at the site of installation. The general rule is to use the three-bay system where operating speeds are less than 60 kilometers per hour (40 miles per hour). The six-bay system is then used for sites with higher operating speeds.

INSPECTION CHECKLISTS -- G.R.E.A.T. CZ Date Inspected: / / Inspector: Location of Device: Mile Post and Roadway or Job Number Any questions answered NO should be discussed with supervisor. YES NO 1. Have all cartridges been inspected and replaced if necessary? 2. Are all bolts tight? Tap fender panels lightly with a hammer. Loose bolts will rattle. 3. Is the unit free from significant rust that could impair its impact performance? 4. Is the area beneath the G-R-E-A-T CZ unit free of debris? 5. Are the diaphragms in good condition and installed so that they are at right angles to the fender 6. Does the chain peg for each diaphragm point toward traffic? 7. Are chains over the peg on every diaphragm? 8. Is a retaining pin used to anchor the chain to the platform? Is the restraining cable properly installed, and does it pass through the cable guides on the first two diaphragms on six-bay units and one diaphragm on three-bay units? 10. Is the restraining cable tight? (Note: Not required for three-bay units.) 11. Are the fender panels free from any unnecessary bolts or other objects obstructing their movement? 12. Are diaphragm shoes free to slide? 13. Do all fender panels except those on the sides of the last bay have deflector clips attached to the rear outside surface with the angled portion turned outward toward traffic? 14. Are mushroom bolt assemblies installed properly? Near back of long slotted hole; long axis in horizontal direction? Bolt head flush with mushroom washer surface? Edges conforming to w-beam, and bolts properly torqued? 15. Is the transition panel at the rear of the unit in place for bi-directional traffic situations? 16. Are all parts used in the GCZ the proper manufacturer-supplied parts? 17. Is the GCZ properly anchored with 22 anchors for the six-bay system, 16 anchors for the threebay system? 18. Are anchors secured, with surrounding pavement in good condition? 19. Is the GCZ installed either on a level asphalt or concrete pad, in good condition, or, failing this, is the DPA system employed? 20. Is the GCZ installed at a site where vehicles can cleanly impact the unit without interference from other objects? 21. Is the site where the GCZ is located level, with no curbs or islands underneath the unit? 22. Does the GCZ have an adequate number of bays for the design speed at the site (6 bays for speeds > 60 kilometers per hour (40 miles per hour), 3 bays for speeds < 60 kilometers per hour (40 miles per hour))? For questions answered NO, state the question number and problem: State the action resulting from questions answered NO:

Time and date that the problem was resolved:

Signature and Title:

Module XI.B. Sand-Filled Barrels

INSTRUCTION SUMMARY

Duration:

15 minutes

Objective:

To describe inspection points for sand-filled barrels

Content:

Site Requirements, Operating/Design Speed, Condition/Quality, Sand/Weight

Inspection, Location and Orientation, Refurbishment

Equipment:

Overhead Projector

Aids:

13 Overheads

PRESENTATION OPTIONS

The participant's notebook includes information from the Texas DOT's "Inspector's Training Manual." Some agencies may publish specific duties of inspectors that can be substituted. If nothing specific to the agency is available, question participants about how their agency is different.

LESSON PLAN

Introduction

- Sand barrels are Module XI.B. of the Participant's Notebook.

OV11B-1 - SAND-FILLED BARRELS

- Kinetic energy transfer.
- Most often used at concrete barrier terminals.

OV11B-2 - Close-up of sand barrels showing weight written on side

- This shows a barrel installation in the field.
- Note the weight of sand written on the barrel's side.

OV11B-3 - SITE REQUIREMENTS

- Rear barrel overlap is important to avoid vehicles colliding with rear of cushion from the side and impacting fixed object.

- 375 millimeters (15 inches) is permissible in special work-zone situations.
- Paved surface; metal sheets under plywood can be used to allow easy movement.
- Placing on wood pallets is a serious safety risk; raises center of gravity of barrels; impairs impact performance.

OV11B-4 - Photo of barrel installation with 4x4 laying on barrels

- What is NOT acceptable in a site.
- Four by four is a major hazard; could pass through windshield in accident.

OV11B-5 - OPERATING SPEED

- Number of barrels based on design speed because of amount of sand needed for sufficient kinetic energy transfer.

OV11B-6 - BARREL CONDITION

- Sound barrels; look for cracks, cuts.
- Secure lids necessary to keep vandals out.
- Color, retroreflectorization compliance.

OV11B-7 - SAND INSPECTION

- Remove lid; check code; check amount of sand.
- Tap barrel to check for diaphragms.
- Loose, dry sand required; other items become deadly in an accident.

OV11B-8 - Photo of inspector lifting sand barrel lid

- Inspector looking inside.
- Two main systems: Energite and Fitch.

OV11B-9 - Orange artwork drawing of Energite diaphragm system

- Energite has one level line with differently-shaped diaphragms for different weights.
- Heaviest barrels, diaphragm omitted.

OV11B-10 - Photocopy of Fitch diaphragm system

- Fitch similar, but one diaphragm is used.
- Various level lines indicate weight in barrel.

Heaviest barrels, diaphragm omitted.

OV11B-11 - CRASH CUSHION LOCATION AND ORIENTATION

- Check barrel location, "walking."
- Is there approximately a 150-millimeter (6-inch) spacing between sand barrels?
- Cushion rotatation:
 - Improves impact performance.
 - Reduces risk of side impacts.

OV11B-12 - Participant's Notebook figure showing barrel spacing

Shows typical spacing between barrels.

OV11B-13 - REFURBISHMENT

- Refurbishing crash cushions sometimes becomes major problem.
- Keeping modules in stock greatly reduces the problem.

VISUAL AIDS

OV11B-1 - SAND-FILLED BARRELS

- Slow errant vehicle through kinetic energy transfer.
- Dissipates vehicle momentum, bringing it to a controlled stop.
- Used to protect motorists from fixed objects such as barrier ends, bridge piers, etc.

OV11B-2 - Close-up of sand barrels showing weight written on side

OV11B-3 - SITE REQUIREMENTS

- Do the rear barrels overlap (in width) the fixed object on the traffic side by at least 750 millimeters (30 inches).
- Are the barrels placed on a smooth, uniform, level surface, with no more than a 10:1 ratio?
- Is the ground surface under the barrels paved, or are the barrels set onto plywood, which is then set onto metal sheets?
 - NEVER place barrels on wood pallets.

OV11B-4 - Photo of barrel installation with 4x4 laying on barrels

OV11B-5 - OPERATING SPEED

• Is the number of barrels appropriate for the design speed at the site?

OV11B-6 - BARREL CONDITION

- Are all barrels sound, and are the sides of the barrels free from cracks or cuts?
 - UV radiation can cause splitting.
 - Sand can be lost, resulting in less-than-optimal impact performance.
 - Nylon bands can reduce this problem.
- Are the lids of the barrels secured?
- Are the barrels yellow in color or retroreflectorized in accordance with the TCP?

OV11B-7 - SAND INSPECTION

- Remove sheet metal screws to remove lid.
- Does the drum insert diaphragm code match the weight specified for the module?
- Does each barrel have the proper amount of sand in it?
- Are the appropriate sand supports used in each barrel?
 - Tap side of container at bottom to check for diaphragms.
- Is only loose, dry sand used in each barrel?
 - Rocks, bolts, and other items commonly substituted can become deadly projectiles in an accident.

OV11B-8 - Photo of inspector lifting sand barrel lid

OV11B-9 - Orange artwork drawing of Energite diaphragm system

OV11B-10 - Photocopy of Fitch diaphragm system

OV11B-11 - CRASH CUSHION LOCATION AND ORIENTATION

- Are the barrels arranged as shown in the plans?
 - Barrel arrays can tend to "walk" across bridge surfaces; check for discrepancies in location versus what is specified by the TCP.

- Is there approximately a 150-millimeter (6-inch) spacing between sand barrels?
- Is the crash cushion rotated a maximum of 10 degrees towards the approach traffic?
 - Some rotation improves impact performance.
 - Reduces risk of side impacts.

OV11B-12 - Participant's Notebook figure showing barrel spacing

OV11B-13 - REFURBISHMENT

- Are there spare modules in stock or quickly available in the event of an impact?
 - Rapid refurbishment of crash cushions is vital for safety and liability reasons.

Module XI.B. Sand-Filled Barrels

Participant's Notebook Text INTRODUCTION

Visual Aids

Sand barrels are sometimes used as a crash-attenuation device in construction zones. The sand-filled plastic barrel crash cushion is an inertial system that includes free-standing, energy-dissipating modules. The individual containers are made of a brittle plastic material that splits open easily upon impact by an errant vehicle. This impact accelerates the sand within, thereby transferring kinetic energy from the vehicle to the sand. This transfer dissipates momentum and brings the impacting vehicle to a controlled stop.

OV11B-1 Sand-Filled Barrels

In construction zones, sand barrels are normally used to protect errant motorists from fixed objects such as exposed barrier ends, bridge piers, etc.

OV11B-2 Close-up of sand barrels showing weight written on side

Do the rear barrels overlap (in width) the fixed object on the traffic side by a minimum of 750 millimeters (30 inches)?

OV11B-3
Site Requirements

The sand barrel crash cushion is non-redirective. That is, it will not redirect a vehicle impacting the side of the array away from the fixed object. As a result, the impacting vehicle may be decelerated much faster than desired, or it may impact the fixed object at a relatively high speed. To cut down on this type of impact, it is important to ensure that the last three modules on each side of the array are placed no less than 750 millimeters (30 inches) outside (toward the traffic side) the fixed object that the array is protecting. This is shown in figure 11B-1.

OV11B-4 Photo of barrel installation with 4x4 laying on barrels

In some special cases in work zones, it is not possible to obtain the 750-millimeter (30-inch) spacing discussed above. In these special cases, where the fixed object cannot be moved or otherwise protected, it is permissible to install sand barrels with only a 375-millimeter (15-inch) offset to the traffic side of the fixed object.

Are the barrels placed on a smooth, uniform level surface, with no more than a 10:1 ratio?

A smooth, uniform level surface is needed to ensure good performance of the sand barrel system. No more than a 10:1 ratio can be permitted. If the site does not conform to this guideline, search for alternatives at that site that could allow the problem to be corrected. For example, if the sand-filled barrel array is protecting the exposed end of concrete traffic barrier, perhaps an additional section

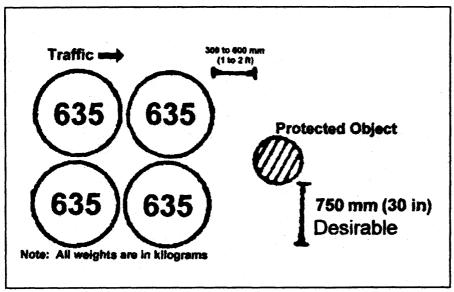


Figure 11B-1. Protected object width.

of temporary concrete barrier could be added to allow the minimum conditions to be met.

Is the ground surface under the barrels paved, or are the barrels set onto metal sheets?

When the surface at the crash cushion location is not paved, the sand-filled barrels should be placed on plywood, which should be set onto metal sheets. NEVER place the modules onto wood pallets. If the modules need to be relocated frequently, a 15-millimeter (0.5-inch) steel plate with eye bolts in the corner can be used to lift the sand barrels for relocation. The wood pallet will raise the center of gravity of the sand mass, which may present a hazard to impacting vehicles.

Is the number of barrels appropriate for the design speed at the site?

Figures 11B-2, 11B-3, and 11B-4 present information on the proper configuration for sand barrel arrays to be used at sites with differing design speeds. Figure 11B-2 is to accommodate speeds up to 60 kilometers per hour (40 miles per hour), 11B-3 shows a system for speeds near 80 kilometers per hour (50 miles per hour), and 11B-4 shows a system for design speeds of around 95 kilometers per hour (60 miles per hour).

OV11B-5 Operating Speed

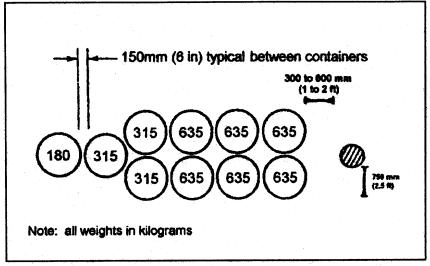


Figure 11B-2. Sand-filled barrel configuration for 60 kph (40 mph) design speed.

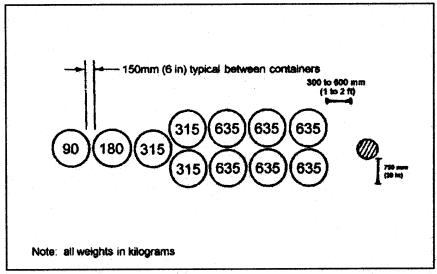


Figure 11B-3. Sand-filled barrel configuration for 80 kph (50 mph) design speed.

Are all barrels sound, and are the sides of the barrels free from cracks or cuts?

Check the condition of the plastic barrels. Splitting of the sides of the plastic containers due to exposure to the sun is common. This ultraviolet exposure causes the plastic to split and sand to be lost from the barrels. Any containers that are split should be replaced as soon as possible. Nylon banding of the containers can reduce this problem.

OV11B-6 Barrel Condition

Are the lids of the barrels secured? Are barrels yellow in color or retroreflectorized in accordance with the plan sheet?

Check the lids of the barrels to ensure they are secured with sheet metal screws or a similar mechanism to discourage easy access to the contents. Vandalism of the barrels, and placing foreign items within, is common in some locations. Also the barrels themselves should be yellow in color in accordance with the project plans. Sometimes retroreflectorization or delineation is also required on the first container.

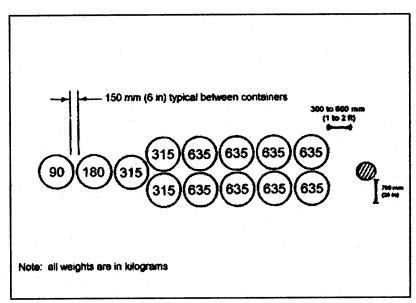


Figure 11B-4. Sand-filled barrel configuration for 95 kph (60 mph) design speed.

Does the drum insert diaphragm code match the weight specified for the module?

OV11B-7 Sand Inspection

Does each barrel have the proper amount of sand in it?

OV11B-8
Photo of inspector
lifting sand barrel lid

Each barrel must have the proper amount of sand in it for the system to perform properly. Two basic systems are available: Energy Absorption's Energite barrel system and the Fitch barrel system.

OV11B-9 Orange artwork drawing of Energite diaphragm system

For the Energite system, first remove the sheet metal screws securing the lid. The Energite system has a cone-shaped diaphragm within it that holds the sand off the ground at the proper level to ensure correct impact performance. The inside of the barrel has a line on it to which the sand should be filled. Brush away the sand to see the cone inside. The cone is labeled with a certain number corresponding to the weight of sand in the barrel if the barrel is filled, using that cone, to the fill line on the inside of the barrel. See figure 11B-5 illustrating the Energite diaphragm system.

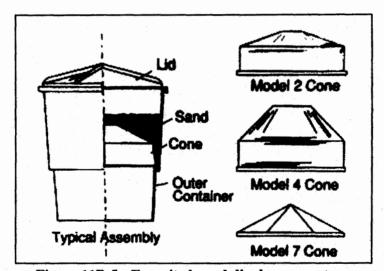


Figure 11B-5. Energite barrel diaphragm system.

For the Fitch system, the sheet metal screws securing the lid must also be removed first. The Fitch barrels have a specific diaphragm that should be used for each barrel size as well as a series of fill lines on the inside of the barrel. These lines correspond to the weight of sand in the barrel when the proper diaphragm has been used and the barrel filled to the line. Lift the lid off the container and compare the desired weight (from the barrel configuration or traffic control plan) to the weight level line at the top of the sand. Lack of a visible weight level line means either the wrong module or diaphragm has been used or the container has been over-filled. See figure 11B-6 for an illustration of the Fitch barrel system.

OV11B-10 Photocopy of Fitch diaphragm system

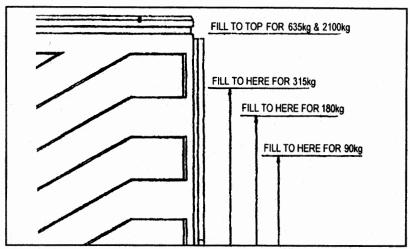


Figure 11B-6. Fitch barrel system.

Are the appropriate sand supports used in each barrel?

Each barrel in both systems has an interior diaphragm. Its position in the sand container depends on the total weight of sand required in the barrel. This interior diaphragm is critical to ensure that the center of gravity of the sand mass in the container is placed near the center of gravity of the impacting vehicle. Too often, the interior diaphragm is simply omitted and too much sand is placed in the containers. To check for a missing diaphragm, tap the containers on the side near the bottom. The container should sound hollow. If the sound is deadened, the diaphragm has probably been left out. Note that this test does not apply to the 635-kilogram (1400-pound) barrels, as they contain no diaphragms.

Is only loose, dry sand used in each barrel?

Check to ensure that the only material used in the container is loose, dry sand. A very common field problem is the use of any available material to fill the modules. Large rocks, bolts, pieces of metal, and similar items have been found in sand barrels. Remember, the impacting vehicle will accelerate the material in the container to the speed of the vehicle. A one pound rock travelling at fifty miles per hour can injure a person nearby.

Are the barrels arranged as shown in the plans? Is there approximately a 150-millimeter (6-inch) spacing between sand barrels?

Check that the crash cushion is located properly as specified in the traffic control plan. A common problem observed with sand-filled barrel arrays is a gradual movement across the pavement when the array is installed on a bridge structure. The modules move out of position, which creates problems with the

OV11B-11 Crash Cushion Location and Orientation device's impact performance. A quick solution to this problem is to attach an angle clip to the pavement and pop rivet it to the container. Another method is to shoot a nail into the pavement under each module. Wire is then placed through a hole in the rim of the container, then under the container edge, and around the nail.

Often, the crew initially installing the barrels may paint circles on the ground that correspond to the correct barrel locations according to the plans. At this time they will also often paint numbers inside the circles that will give the weight of the barrel that is supposed to be at that location. This information can be useful for reinstalling barrels at a site after an impact, when the plans are not readily available and the barrels must be reinstalled quickly because the hazard they were protecting is dangerously exposed. The plans should be checked as soon as possible to ensure that the correct barrel configuration was used, however.

Another item to check for is the existence of a small spacing between the installed barrels. Refer to earlier figures 11B-2,3, and 4 for an illustration of this concept. The spacing should be approximately 150 millimeters (6 inches) between barrels.

OV11B-12 Participant's Notebook figure showing spacing

Is the crash cushion rotated a maximum of 10 degrees towards the approach traffic?

The crash cushion should be rotated slightly toward the approaching traffic (maximum rotation from the roadway parallel should be 10 degrees). This will generally align the device better with the impacting vehicle, thus improving impact performance. It also reduces the risk of side impacts.

Are there spare modules in stock or quickly available in the event of an impact?

OV11B-13 Refurbishment

Check to ensure that provisions have been made to quickly refurbish the sand barrel array in the event of an impact. Contractor or highway agency personnel should have a plan for installing spare barrels or some other provision to help ensure safety at the site quickly as a hazard may exist after the sand barrel debris has been cleared. This is important for safety as well as liability reasons.

INSPECTION CHECKLIST -- Sand-Filled Barrels

Date	e Inspected:/ / _ Inspector:ation of Device:					
	Mile Post and Roadway or Job Number					
Any	questions answered NO should be discussed with supervisor.	YES	NO			
1.	Do the rear barrels overlap (in width) the fixed object on the traffic side by a minimum of 750 millimeters (30 inches)?					
2.	Are the barrels placed on a smooth, uniform level surface, with no more than a 10:1 ratio?					
3.	Is the ground surface under the barrels paved, or are the barrels set onto metal sheets?					
4.	Is the number of barrels appropriate for the design speed at the site?					
5.	Are all barrels sound, and are the sides of the barrel free from cracks or cuts?					
6.	Are the lids of the barrels secured?					
7.	Are barrels yellow in color or retroreflectorized in accordance with the plan sheet?					
8.	Does the drum insert diaphragm code match the weight specified for the module?					
9.	Does each barrel have the proper amount of sand in it?					
10.	The state of the s					
11.	Is only loose, dry sand used in each barrel?					
	Are the barrels arranged as shown in the plans?					
	Is there approximately a 150-millimeter (6-inch) spacing between sand barrels?					
14.	Is the crash cushion rotated a maximum of 10 degrees towards the approach traffic?		***********			
15.	Are there spare modules in stock or quickly available in the event of an impact?					
	For questions answered NO, state the question number and problem:		_			
	State the action resulting from questions answered NO:					
Tim	ne and date that the problem was resolved:					
Sign	Signature and Title:					

Module XI.C. ADIEM (Advanced Dynamic Impact Extension Module)

INSTRUCTION SUMMARY

Duration:

5 minutes

Objective:

To describe points that should be covered when inspecting the ADIEM

Content:

Location, Foundation, Dimensions, Base Inspection, Module Installation and

Delineation, Refurbishment

Equipment:

VCR

Aids:

5-minute Videotape

PRESENTATION OPTIONS

The ADIEM video was produced by Syro, the manufacturer of the ADIEM. If the videotape is unavailable or undesirable, slides or overheads could be made to cover the module content similarly.

LESSON PLAN

- Introduce the ADIEM as Module XI.B. of the Participant's Notebook.
- Briefly discuss the inspection checklist at the rear of Module XI of the Notebook.

VISUAL AIDS

Video - 5 minutes

Module XI.C. ADIEM (Advanced Dynamic Impact Extension Module)

Participant's Notebook Text INTRODUCTION

Visual Aids Video - 5 minutes

The ADIEM is a energy-absorbing crash cushion, often used as a concrete barrier terminal. It consists basically of a sloped base anchored to the ground and a series of perlite concrete cartridges to absorb the energy of an impacting vehicle. The base contains a sliding rail system into which the cartridges fit, as shown in figure 11C-1. The cartridges slide to the back of the base (nearest the concrete barrier end) and provide the impact absorbing energy in head on collisions by errant vehicles. The sloped base provides redirective capability in the event of a side impact.

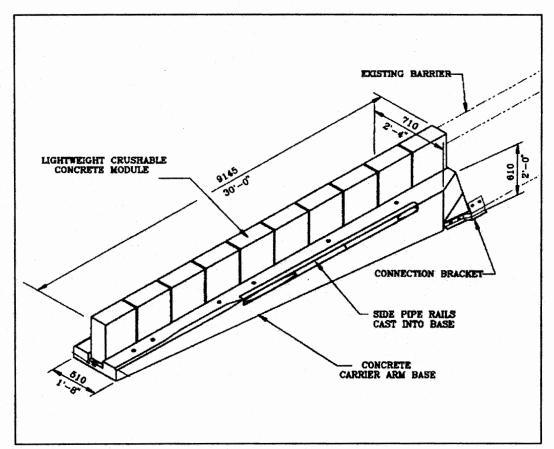


Figure 11C-1. ADIEM base and cartridge arrangement.

Is the ADIEM located properly according to the plans?

Check to make sure that the ADIEM is located properly according to the TCP. If the TCP calls for more than one ADIEM at different locations throughout the work

zone, check all those locations and ensure that the proper number and placement are evident for all of the devices called for by the TCP.

Is the foundation on a level surface that is constructed of earth, asphalt, or concrete?

The ADIEM should only be installed on a level surface composed of earth, asphalt, or concrete. The redirecting base of the unit should be evenly aligned with the concrete barrier end that the ADIEM is terminating. Check the unit closely to ensure that the base is securely attached to the end of the portable concrete barrier and to the pavement or ground, as specified in the contract plans.

Is the width 700 millimeters (28 inches)? Is the length 9 meters (30 feet)?

Check the dimensions of the ADIEM. The ADIEM is a singular device from a single manufacturer, and there are no different models or product lines. The ADIEM should always be 700 millimeters (28 inches) wide and 9 meters (30 feet) long.

Is the redirecting base aligned with, and attached to, the portable concrete barrier end which it is protecting? Is the base properly anchored to the pavement or other foundation?

Look along the line of the device to ensure that it is in alignment with the protected barrier end. Inspect the end of the barrier and ensure that the connecting bracket at the back edge of the ADIEM is properly secured to the concrete barrier. Also, the base of the ADIEM should be anchored with 25-millimeter (1-inch) rods driven into the foundation below the unit.

Also, it is critical that the ADIEM base is properly anchored to its foundation. This criteria must be met for the ADIEM to perform correctly during side impacts.

Are the modules properly installed in the channel? Does the end module have proper delineation?

Inspect each of the modules in the ADIEM. Ensure that they are all made of perlite concrete and that each is properly installed in the guide channel at the base of the unit. The end module should be delineated with a retroreflective yellow-and-black stripe pattern, as shown in figure 11C-2, unless otherwise specified in the contract plans. If the plans call for another type of delineation, check to ensure that the installed delineation meets the specification of the plans, or that there is no

delineation installed if the plans specify that there should be none.

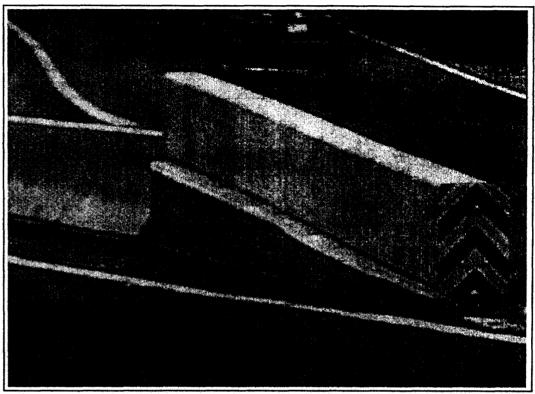


Figure 11C-2. ADIEM delineation.

Are there spare perlite concrete modules in stock or quickly available for installation in the event of an impact with the device?

Check to ensure that provisions have been made to quickly refurbish the ADIEM in the event of an impact. Contractor or highway agency personnel should have a plan for getting spare modules onto the site, as the hazard the device was protecting will be exposed. This is important for safety as well as liability reasons.

INSPECTION CHECKLIST -- ADIEM

Da	Date Inspected:/_/ Inspector:					
Loc	cation of Device:					
	Mile Post and Roadway or Job Number					
Any questions answered NO should be discussed with supervisor.		YES	NO			
1.	Is the ADIEM located properly according to the plans?					
2.	Is the foundation:					
	a. On a level surface?					
	b. Constructed of earth, asphalt or concrete?					
3.	Is the width 700 millimeters (28 inches)?					
4.	Is the length 9 meters (30 feet)?	,				
5.	Is the redirecting base:					
	a. Aligned with the portable concrete barrier?					
	b. Properly attached to the portable concrete barrier?					
6.	Is the base properly anchored to the pavement or other foundation?					
7.	Are the modules properly installed in the channel?					
8.	Does the end module have proper delineation?					
9.	Are there spare perlite concrete modules in stock or quickly available for installation in the event of an impact with the device?	1				
	For questions answered NO, state the question number and problem:					
-						
	State the action resulting from questions answered NO:					
	me and date that the problem was resolved:					

Module XII.A. Portable Concrete Barrier

INSTRUCTION SUMMARY

Duration:

15 minutes

Objective:

To describe inspection points for portable concrete barrier

Content:

TCP Compliance, Location and Placement, Barrier Sections, End Treatments,

Drainage, Connector Inspection

Equipment:

Overhead Projector

Aids:

9 Overheads

PRESENTATION OPTIONS

This presentation will vary depending on the type of barrier connector used in an agency. Overheads should be prepared showing the agency's connector details.

LESSON PLAN

Introduction

- Offers protection for workers and keeps traffic out of work area
- Can be hazardous and increase accidents
- Delineation is important, especially if used at night

OV12A-1 - PORTABLE CONCRETE BARRIER

Will discuss 5 areas

OV12A-2 - END TREATMENTS AND ANCHORING

- 3 Options
- Difficult to run across shoulder

OV12A-3 - LOCATION AND PLACEMENT

- Shy distance
- Lane widths

OV12A-4 - FLARE RATE AND DELINEATION

- Flare rate
- What delineation is called for
- Warning lights

OV12A-5 - BARRIER SECTIONS

- How aligned
- Condition check cracks, chips, corners

OV12A-6 - Picture of barrier sections

- Notice paint and delineator
- Good condition and alignment

OV12A-7 - Picture of drums at end of barrier

- Hazard is well delineated, but not attenuated
- Exposure to opposing traffic?

OV12A-8 - DRAINAGE

- Consider cross-section
- Good idea to inspect during first rain
- Winter, consider melting snow

OV12A-9 - CONNECTORS

- Weakest part of system
- Common types
- Type used in this agency
- Strength, replacement
- Condition
- Size of major components

VISUAL AIDS

OV12A-1 - PORTABLE CONCRETE BARRIER

- End treatments and anchoring
- Location and placement

- Flare rate and delineation
- Barrier section
- Drainage
- Connectors

OV12A-2 - END TREATMENTS AND ANCHORING

- Is an impact attenuator installed at the approach end of the portable concrete barrier; alternately, is the approach end flared away from approaching traffic according to the TCP?
 - Connection to existing barrier
 - Attaching crashworthy end treatment
 - Flaring barrier away to edge of clear zone
- If anchoring is required to prevent lateral movement, is anchoring installed according to the plans and specifications?

OV12A-3 - LOCATION AND PLACEMENT

- Is the distance from the edge of the lane to the concrete barrier at least 0.6 meters (2 feet), with the lane width at least 3 meters (10 feet)?
 - Safe area for lateral displacement
 - Anchoring is an option where little or no safe area is available
 - Areas with some, but less-than-desirable safe areas should limit barrier movement (place barriers on grout bed)

OV12A-4 - FLARE RATE AND DELINEATION

- Is a barrier flare rate in transitions of at least 1:4 maintained, with a higher rate such as 1:5 or 1:6, used along high-speed, high-volume roadways?
- Are barrier delineation elements in place (eg, vertical panels, steady-burn lights, or delineators)?
- If warning lights are installed on continuous barriers, are the first two warning lights flashing, while the remainder are steady-burn?

OV12A-5 - BARRIER SECTION

Sight along the line of barrier; are any of the barrier sections out of line?

- May be worse on curves
- Barriers "walking" across pavement
- Errant vehicle glancing blow
- Causes prestress on sections
- Are the barrier sections free from serious chips, cracks, or broken corners?

OV12A-6 - "Picture of Barrier Section"

OV12A-7 - "Picture of Drums at end of Barrier"

OV12A-8 - DRAINAGE

- Is adequate drainage provided for the pavement surface?
 - Lifting or drainage slots
 - Do NOT set sections on 2x4s or other blocks

OV12A-9 - CONNECTORS

- Are the barrier connectors assembled according to the plans and specifications?
- Are all connections tight and secure?
- Are pins or connectors free from damage?

Module XII.A. Portable Concrete Barrier

Participant's Notebook Text INTRODUCTION

<u>Visual Aids</u> OV12A-1 Portable Concrete Barrier

VO12A-2

Anchoring

End Treatments and

The portable concrete barrier (PCB) is probably one of the most common sights on the highway. Barriers are most often used in construction zones to provide positive protection for workers or protect motorists from hazards such as a steep dropoff. Since they are so commonplace, it is important to be familiar with portable concrete barriers and how to properly inspect them.

Is an impact attenuator installed at the approach end of the portable concrete barrier; alternately, is the approach end flared away from approaching traffic according to the TCP?

If anchoring is required to prevent lateral movement, is anchoring installed according to the plans and specifications?

Inspect the ends of the barrier and compare them to what is called for in the TCP. The end treatments used should fit into one of the following categories:

- Connection to an existing barrier,
- Attaching a crashworthy end treatment such as a crash cushion or impact attenuator (like the GREAT CZ, Sand-Filled Barrels, or ADIEM addressed in Module XI of this notebook), or
- Flaring the barrier system away to the edge of the clear zone. Proper flare rates for different situations are discussed below.

On lower speed installations, the barrier may also be buried in berm or employ a sloped end. Burying in berm is only recommended where speeds are less than 30 kilometers per hour (20 miles per hour). An end taper of approximately 1.5 to 3 meters (5 to 10 feet) should be used in case of soil settlement. The sloped end should only be used where other treatments are infeasible and speeds remain below about 15 to 20 kilometers per hour (10 to 15 miles per hour).

Check to ensure that either impact attenuators are present, or that the approach end of the barrier is flared away from traffic as shown in the TCP. Make sure that the barrier connections are installed and conform to the specifications of the TCP. If called for in the plans, make sure that anchoring is installed and that it is keeping the barrier segments in their proper locations.

Is the distance from the edge of the lane to the concrete barrier at least 0.6 meters (2 feet), with the lane width at least 3 meters (10 feet)?

OV12A-3 Location and Placement The distance from the edge of the lane to the concrete barrier should be at least 0.6 meters (2 feet), and the lane should be at least 3 meters (10 feet) wide where concrete barriers are installed. On the other side of the barriers, there must be some safe area for lateral displacement of the barrier system in an impact. In other words, workers and equipment must be a safe distance away from the inside of the barrier in case it is struck and displaces in towards the work area.

If there is not a safe area between the barrier sections and the work area, check to see if the barrier system has been anchored to the pavement or bridge deck using drift pins or anchor bolts. Also, if these pins are present, check to ensure that they do not protrude beyond the face of the PCB.

If the barrier system is in a location where some limited sliding could safely take place, but no more than a slight amount is acceptable, check that some other method of limiting PCB movement (lateral displacement) has been provided. This would include such methods as placing the PCB sections on a grout bed.

Is a barrier flare rate in transitions of at least 1:4 maintained, with a higher rate such as 1:5 or 1:6 used along high-speed, high-volume roadways?

OV12A-4
Flare Rate and
Delineation

Finally, check to ensure that a barrier flare rate of at least 1:4 is used in transitions. If the barrier system is installed along a roadway with high-speed, high-volume traffic, a higher flare rate, such as 1:5 or 1:6 must be used. Inspector should be familiar with the flare rate in the plans and/or Special Provisions.

Are barrier delineation elements in place (eg, vertical panels, steady burn lights, or delineators)?

If warning lights are installed on continuous barriers, are the first two warning lights flashing, with the remaining warning lights steady-burn?

Check to ensure that the proper barrier delineation elements are in place and properly located according to the TCP. Typically, barriers are delineated with vertical panels, warning lights, or barrier-mounted delineators mounted on small brackets along the top or sides of the barriers. If warning lights are used on a continuous-barrier system, the first two warning lights should be flashing, and the remainder should be steady-burn warning lights.

Sight along the line of barrier; are any of the barrier sections out of line?

OV12A-5 Barrier Section

While inspecting the barrier sections, look down along the line of barrier sections. Check to ensure that none of the barrier sections are out of line by more than a few inches, or enough to significantly introduce rotation in the barrier

OV12A-6

connections, based on the alignment of the barriers. Some variation is inevitable, particularly on curves, but look for areas that look as if they may be "walking" across the pavement, or that may have been struck a glancing blow by a passing vehicle. Again, if the barrier sections are significantly out of alignment, the connections are prestressed beyond the level that will provide adequate resistance to rotation in the event of a vehicle impact. Impact performance will therefore be compromised and serious injuries to motorists or workers could result.

"Picture of Barrier Section"

OV12A-7
"Picture of Drums at end of Barrier

Are the barrier sections free from serious chips, cracks, or broken corners?

Finally, check to ensure that the barrier sections are in good condition and basically free from significant chips, cracks, or a large number of broken corners.

Is adequate drainage provided for the pavement surface?

OV12A-8 Drainage

Check to ensure that adequate drainage is provided for the pavement surface. There should not be water standing due to a lack of adequate drainage, as this could cause motorists to hydroplane and possibly cause a serious accident. Check to ensure that the barrier sections are not set on 2x4s or other blocks to provide drainage, as this creates an unsafe impact condition for the barrier system.

Are the barrier connectors assembled according to the plans and specifications? Are all connections tight and secure? Are pins or connectors free from damage?

OV12A-9 Connectors

The main items to inspect for connectors are that they are the correct connectors according to the TCP, that they are tight and secure, and that they are not damaged, bent or otherwise disfunctional due to barrier movement or glancing impacts. Proper connections in a system of portable concrete barriers is vital to the impact performance of the system.

Three types of connectors, and slight variations of these three, comprise the vast majority of installed connections in PCB. These three connectors are the pin and loop connector, the tongue and groove connector, and the plate insert connector. The basic configurations of these connectors are shown in figure 12A-1.

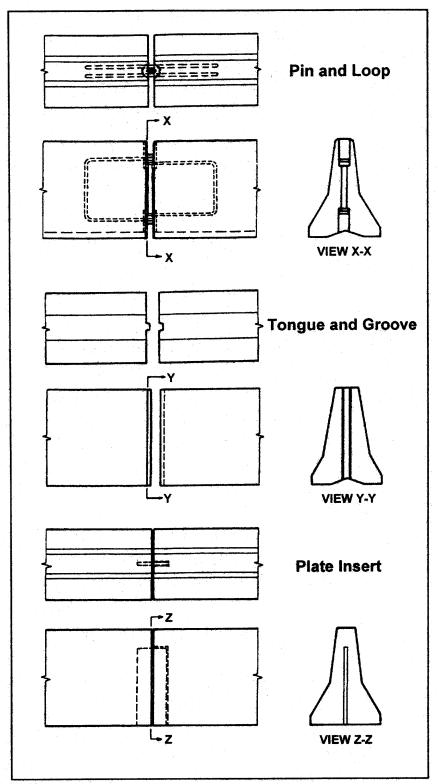


Figure 12A-1. Most common PCB connector configurations.

One important factor to check when considering inspection of barrier connectors is the condition of the barrier segments near the connection points. Broken places are critical near joints when the gap adds to the distance between segments. Gaps of 5 inches or greater are unacceptable.

Check for cracks in the barrier segments near the lifting points and drainage channels. The condition of the connectors should be observed particularly closely at angles, curves, or where barrier segments have been replaced.

For pin and loop connectors, check that the pins are installed and are the proper design and diameter according to the appropriate TCP sheet. Look for cracked, broken, or bent loops.

On tongue and groove connectors, check that at least two-thirds of the tongue's length is in good condition. On the plate insert and other connectors, check for the presence and secure connection of dowel bars and plates.

INSPECTION CHECKLIST -- Portable Concrete Barrier

	e Inspected:/ / _ Inspector:ation of Device:		
Loca	Mile Post and Roadway or Job Number		
Any	questions answered NO should be discussed with supervisor.	YES	NO
1.	Is an impact attenuator installed at the approach end of the portable concrete barrier; or is the approach end flared away from approaching traffic according to the TCP?		
2.	If anchoring is required to prevent lateral movement, is anchoring installed according to the plans and specifications?		
3.	Is the distance from the edge of the lane to the concrete barrier at least 0.6 meters (2 feet), with the lane width at least 3 meters (10 feet)?		
4.	Is a barrier flare rate in transitions of at least 1:4 maintained, with a higher rate, such as 1:5 or 1:6, used along high-speed, high-volume roadways?		
5.	Are barrier delineation elements in place (eg, vertical panels, steady burn lights, or delineators)?		
6.	If warning lights are installed on continuous barriers, are:		
	a. The first two warning lights flashing?		
	b. The remaining warning lights steady-burn?		
7.	Sight along the line of barrier; are any of the barrier sections out of line?	-	
8.	Are the barrier sections free from serious chips, cracks, or broken corners?		
9.	Is adequate drainage provided for the pavement surface?		
10.	Are the barrier connectors assembled according to the plans and specifications?		
11.	Are all connections tight and secure?		
12.	Are pins or connectors free from damage?		
*	For questions answered NO, state the question number and problem:		
			_
	State the action resulting from questions answered NO:		
	ne and date that the problem was resolved:		

Module XII.B. Movable Concrete Barrier

INSTRUCTION SUMMARY

Duration:

10 minutes

Objective:

To describe inspection points for the QuickChangeTM movable concrete barrier

Content:

TCP Compliance, Location and Placement, Barrier Sections, End Treatments,

Drainage, Connector Inspection

Equipment:

Overhead Projector

Aids:

9 Overheads

PRESENTATION OPTIONS

This presentation may need to be changed as broader experience and interest in the movable barrier system is obtained. If new or updated materials become available from the system manufacturer, these should be incorporated into the class presentation, if possible.

LESSON PLAN

Introduction

- The movable barrier is covered in Module XII.B of the Participant's Notebook.
- The advantage of the movable barrier is usually in situations where it is desirable to vary the capacity of the work zone in different directions at different times.
- Many inspection items similar as for normal portable concrete barriers.

OV12B-1 - MOVABLE CONCRETE BARRIER

Will discuss 5 areas

OV12B-2 - TCP COMPLIANCE

- End treatments/attenuators
- Connectors up to specs
- Traffic control procedures
 - Procedures from TCP
 - Time of transfer

Use of advance warning vehicles

OV12B-3 - "Picture of transfer vehicle approaching movable barrier installation"

- This shows both the vehicle and barrier configuration

OV12B-4 - CONNECTORS AND DELINEATION

- Tight and secure connectors, good condition
- Pins seated properly
- Proper delineation (vertical panels, steady-burn warning lights, delineators, striping)

OV12B-5 - BARRIER SECTIONS

- Alignment
- Structural defects

OV12B-6 - "Picture of misaligned, delineated movable barrier installation"

- Note delineators
- Minor misalignments such as these are not a problem
- Larger misalignments require manual straightening before the transfer vehicle is used

OV12B-7 - DRAINAGE

- Built-in drainage system
- Debris can cause problems
- Usually only occurs at installations where the barrier is moved infrequently

OV12B-8 - TRANSFER VEHICLE

- Safety first
- Arrow panel, warning lights
- Safety belts and harnesses (drivers and operators)

OV12B-9 - "Picture of transfer vehicle in closeup"

Typical vehicle configuration shown

VISUAL AIDS

OV12B-1 - MOVABLE CONCRETE BARRIER

- TCP compliance
- Connectors and delineation
- Barrier sections
- Drainage
- Transfer vehicle

OV12B-2 - TCP COMPLIANCE

- Are there impact attenuators at the ends of the barrier alignment facing approaching traffic, or failing this, are the barrier ends flared away from traffic?
- Are the barrier connectors assembled according to the plans and specifications?
- Is the traffic control plan (eg, traffic control procedures, time of barrier transfer, advance warning vehicles, etc.) implemented according to the plans and specifications?

OV12B-3 - "Picture of transfer vehicle approaching movable barrier installation"

OV12B-4 - CONNECTORS AND DELINEATION

- Are the barrier connectors tight and secure, and in good condition?
- Are the connector pins seated down properly between the barrier sections?
- Are barrier delineation elements in place (eg, vertical panels, steady burn lights, delineators, or striping)?

OV12B-5 - BARRIER SECTIONS

- Are the barrier sections generally aligned properly (no sections > 3 feet out of alignment)?
- Are the barrier sections free from structural defects that might affect their impact performance?

OV12B-6 - "Picture of misaligned, delineated movable barrier installation"

OV12B-7 - DRAINAGE

Is the system's drainage capability impaired by unusual debris?

OV12B-8 - TRANSFER VEHICLE

- Are the optional arrow panel (See VI. Arrow Panels) and warning lights (See X. Lighting Devices) on the transfer vehicle in acceptable condition?
- Are the safety features (e.g., safety belts) on the transfer being properly utilized?

OV12B-9 - "Picture of transfer vehicle in closeup"

Module XII.B. Movable Concrete Barrier

Participant's Notebook Text INTRODUCTION

Visual Aids

The Movable Concrete Barrier system is a device that allows highway agencies to move a concrete barrier system up to one lane laterally in a very short time. It is very useful for situations such as bridge deck repairs on high-volume roadways, and others.

OV12B-1 Movable Concrete Barrier

The system is manufactured by Barrier Systems, Inc. of Carson City, Nevada. The basic configuration of the system's barrier sections is illustrated in figure 12B-1.

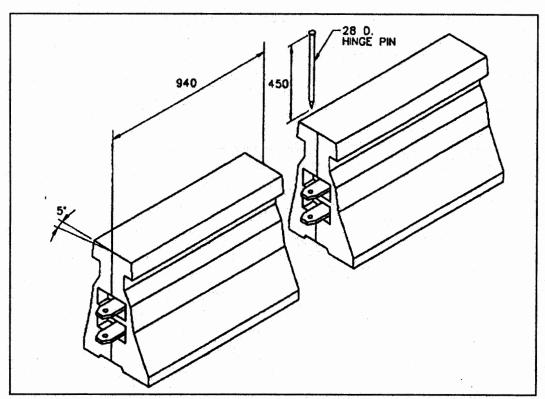


Figure 12B-1. Movable concrete barrier sections.

Are there impact attenuators at the ends of the barrier alignment facing approaching traffic, or failing this, are the barrier ends flared away from traffic?

OV12B-2 TCP Compliance

Are the barrier connectors assembled according to the plans and specifications?

Is the traffic control plan (eg, traffic control procedures, time of barrier transfer, advance warning vehicles, etc.) implemented according to the plans and specifications?

Inspect the ends of the barrier and compare them to what is called for in the TCP. Check to ensure that either impact attenuators are present, or that the approach end of the barrier is flared away from traffic as shown in the TCP. Make sure that the barrier connections are installed and conform to the specifications of the TCP. If called for in the plans, make sure that anchoring is installed and that it is keeping the barrier segments in their proper locations.

It is particularly important for movable concrete barriers to ensure that the TCP is adhered to. The TCP for a project employing movable concrete barriers should specify when and how the barrier is to be moved, special traffic control procedures, and warning devices or vehicles that will be used during barrier transfer to facilitate a safe, effective operation. When inspecting a work zone that employs movable concrete barriers, schedule an inspection at a time when the barrier transfer operation can be observed. Check to ensure that the specifications of the TCP concerning the aforementioned items are carried out.

OV12B-3
"Picture of transfer vehicle approaching movable barrier installation"

Are the barrier connectors tight and secure and in good condition? Are the pins seated down properly between the barrier sections?

OV12B-4 Connectors and Delineation

Inspect the connectors to ensure that they are tight and secure, and that they are not damaged, bent, or otherwise dysfunctional due to barrier movement or glancing impacts. Sometimes the pins between the barrier sections can "ride up." Check for this, and make sure the pins are reseated properly. Proper connections are vital to the impact performance of the system.

Are barrier delineation elements in place (eg, vertical panels, steady burn lights, delineators, or striping)?

OV12B-5
Barrier Sections

Check to ensure that the proper barrier delineation elements are in place and properly located according to the TCP. Special rules apply to delineation of the movable barrier. Care must be taken in placement of the delineation devices, due to the manner in which the transfer vehicle picks up the sections. Warning lights or delineators can be placed along the tops of the barrier sections, but a special transfer vehicle must be used that allows for more clearance along the tops of the barrier. Otherwise, and delineation devices (warning lights, delineators, striping) should only be mounted along the bottom sloped portion of the barrier section. See Figure 12B-2. If warning lights are used on a continuous-barrier system, the first two warning lights should be flashing, and the remainder should be steady-burn warning lights.

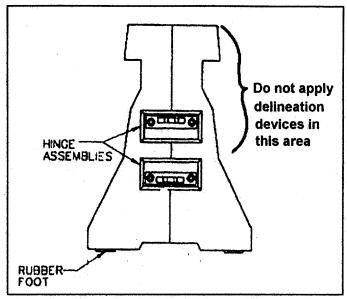


Figure 12B-2. Barrier section delineation.

Are the barrier sections generally aligned properly (no sections > 1 meter (3 feet) out of alignment)?

Movable barriers do not experience quite the same performance problems with misaligned barrier sections that standard portable concrete barriers have. This is partially because the system employs a pass-through cable that provides system continuity in an impact. Also, glancing blows are not a problem, since the transfer vehicle will correct any minor misalignments when the barrier system is transferred. The only problem in this area to be wary of is that, if the barrier sections are out of alignment by more than about 1 meter (3 feet), they can cause the transfer vehicle to "lock up" when traversing the barrier. Inform the project engineer of this condition to ensure that the out-of-alignment sections are manually readjusted before the transfer vehicle is again used.

Are the barrier sections free from structural defects that might affect their impact performance?

The barrier sections should be in good condition and basically free from structural defects that could impair the impact performance of the system. However, because the movable barriers are moved often and because of the wear and tear they receive as a result, a larger amount of chipping and cracking may be evident at the corners of the sections than with non-mobile barrier systems. This usually will not cause a serious problem, however. Instead, look for signs that the barrier has had its

OV12B-6
"Picture of
misaligned,
delineated movable
barrier
installation"

structural integrity impaired (cracks through the centers of the barrier section, broken off or inadequate T-sections, etc.)

Is the system's drainage capability impaired by unusual debris?

OV12B-7 Drainage

There are open channels between the barrier sections both for this purpose and also for flexibility of movement when being transferred with the transfer vehicle. Furthermore, there is a drainage channel in the bottom of the sections that runs down the centerline of the barrier system. However, it is important to check that debris (piles of leaves, sand, etc.) does not block these drainage channels, as water ponding could result. This problem can occur when the vehicle is transferred across lanes, as it is possible for the transfer vehicle to set the system down into the middle of debris already on the road. This will most likely occur if the system is one that is moved only infrequently. If this condition exists, it may be necessary to sweep the area to which the barrier system is being moved before transfer.

Are the optional arrow panel (See VI. Arrow Panels) and warning lights (See X. Lighting Devices) on the transfer vehicle in acceptable condition? Are the safety features (e.g., safety belts) on the transfer vehicle being properly utilized?

OV12B-8 Transfer Vehicle

A special vehicle is used to lift and move the barrier sections. Check to ensure that the transfer vehicle is delineated properly according to the TCP. Typically, the transfer vehicle is equipped with several warning lights. An arrow panel may optionally be installed. Check to ensure that these, or other safety devices, on the vehicle are in acceptable condition by referring to the appropriate section of this notebook.

OV12B-9
"Picture of transfer vehicle in closeup"

Also, check to ensure that the safety features of the transfer vehicle are being properly utilized. This typically consists of safety belts used to protect the operators of the transfer vehicle in the event of an impact by an errant vehicle.

INSPECTION CHECKLIST -- Movable Concrete Barrier

	e Inspected:/_/ Inspector:ation of Device:		
	Mile Post and Roadway or Job Number		
Any	questions answered NO should be discussed with supervisor.	YES	NO
1.	Are there impact attenuators at the ends of the barrier alignment facing approaching traffic, or failing this, are the barrier ends flared away from traffic?		**************************************
2.	Are the barrier connectors assembled according to the plans and specifications?	**************	
3.	Is the traffic control plan (eg, traffic control procedures, time of barrier transfer, advance warning vehicles, etc.) implemented according to the plans and specifications?		
4.	Are the barrier connectors tight and secure and in good condition?		
5.	Are the connector pins seated down properly between the barrier sections?		-
6.	Are barrier delineation elements in place (eg, vertical panels, steady burn lights, delineators, or striping)?		
7.	Are the barrier sections generally aligned properly (no sections > 1 meter (3 feet) out of alignment)?		
8.	Are the barrier sections free from structural defects which might affect their impact performance?	***************************************	adjuntary and a second
9.	Is the system's drainage capability impaired by unusual debris?		
10.	Are the optional arrow panel (See VI. Arrow Panels) and warning lights (See X. Lighting Devices) on the transfer vehicle in acceptable condition?		
11.	Are the safety features (e.g., safety belts) on the transfer being properly utilized?	-	
	For questions answered NO, state the question number and problem:		
	State the action resulting from questions answered NO:		
,			
-			_
	ne and date that the problem was resolved:nature and Title:		

Module XII.C. Plastic Water-Filled Barrier

INSTRUCTION SUMMARY

Duration:

5 minutes

Objective:

To introduce and briefly describe the various plastic water-filled barrier systems

Content:

Plastic Water-Filled Barriers, Triton, Guardian, NCHRP Report 350

Equipment:

Overhead Projector

Aids:

3 Overheads

PRESENTATION OPTIONS

This presentation may need to be changed as new designs become available, and broader experience and interest in these barrier systems are obtained. If new or updated materials become available from manufacturers, they should be incorporated into the class presentation.

LESSON PLAN

Introduction

- Plastic water-filled barriers are covered in Module XII.C. of the Participant's Notebook

OV12C-1 - Plastic Water-Filled Barriers

- Main advantage is easy installation and removal
- Little inspection experience exists
- NCHRP Report 350 test specifications
- Two systems available

OV12C-2 - Triton Barrier

- 6.5 foot sections
- Polyethylene
- Orange and white

OV12C-3 - Guardian Safety Barrier

- Similar to Triton
- Better impact performance with 350 Highway Kit
- Slightly more complicated installation procedures

VISUAL AIDS

OV12C-1 - PLASTIC WATER-FILLED BARRIER

- Easy installation and removal
- Devices are fairly new
- NCHRP Report 350-Compliant
- Two commercially-available systems:
 - Triton
 - Guardian

OV12C-2 - "Picture of Triton Barrier"

OV12C-3 - "Picture of Guardian Barrier"

Module XII.C. Plastic Water-Filled Barrier

Participant's Notebook Text INTRODUCTION

Visual Aids

The format for this section of your notebook varies slightly from the rest of the device modules. Since the Plastic Water-Filled Barrier is such a new device, it has not experienced widespread use. Inspection problems and items are not as well-known as for some of the more well-established items. Consequently, this section of your notebook does not include the "question-then-answer" format followed by a checklist that is typical of the other modules.

Instead, a short introduction to the barriers is in order, after which the two commercially-available systems (as of the writing of this Notebook) will be briefly discussed.

PLASTIC WATER-FILLED BARRIERS

OV12C-1 Plastic Water-Filled Barrier

Plastic water-filled barriers are a fairly recent development in traffic control. The purpose of these devices is to provide positive protection for workers in work zones where concrete barriers would be useful, but not practical. This often consists of those work zones where the duration required for the use of the barriers is too short to justify the labor, expense, and hazards of installing and uninstalling conventional concrete barriers.

In these situations, the light weight and quick set-up and tear-down times of plastic water-filled barriers make them very useful. The barriers can typically be installed in a fraction of the time of concrete barriers and removed almost as quickly. They are easily refurbished in the event of an impact, and they provide real positive protection for workers in most impact situations.

TRITON WATER-FILLED BARRIERS

OV12C-2
"Picture of Triton
Barrier"

The proprietary Triton Barrier system is made by Energy Absorption Systems of Chicago, Illinois. The system consists of interlocking 6.5-foot sections made of polyethylene plastic. After placement, the sections are filled with 145 gallons of water resulting in a weight of 1,350 pounds for each section. This barrier has been crash tested at 45 mph and an impact angle of 25 degrees. The Triton meets the crashworthy design specifications of NCHRP Report 350.

The advantage of the Triton Barrier is the ease of installation and removal. Its contrasting orange and white color scheme results in a high visibilty barrier during both day and night conditions. The Triton Barrier is illustrated in figure 12C-1.

GUARDIAN WATER-FILLED BARRIERS

OV12C-3
"Picture of
Guardian Barrier"

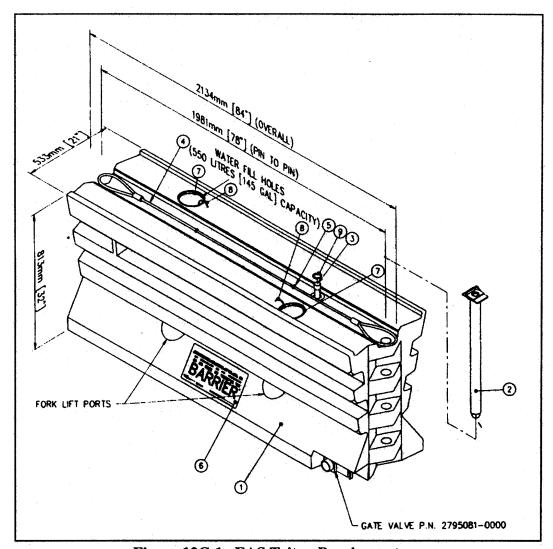


Figure 12C-1. EAS Triton Barrier system.

The Guardian Safety Barrier is similar in design to the Triton Barrier. It is made by the YEW Corporation in Wilkes-Barre, Pennsylvania. It also consists of alternating orange-and-white barrier sections. However, the Guardian Safety Barrier consists of 6-foot sections that are taller than those of the Triton. This design makes the Guardian lighter than the Triton for installation purposes, while it is actually heavier than the Triton when filled with water.

The Guardian Safety Barrier also can be used with the "350 Highway Kit."

This consists of a set of orange-and-white steel brackets and cables that basically comprise an external framework for the barrier system. This results in an overall stronger barrier than the Triton. However, the Guardian with 350 Highway Kit is more complex to install than the Triton. The system is shown with the 350 Highway Kit attached in figure 12C-2.

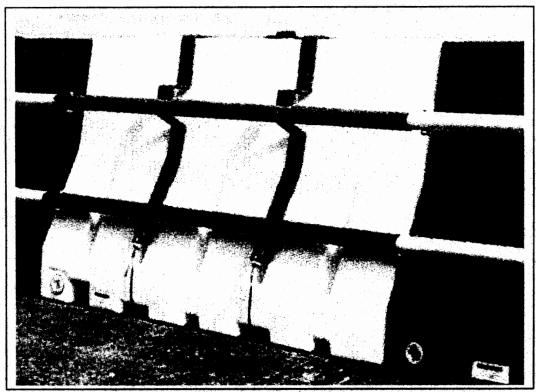


Figure 12C-2. YEW Corporation Guardian Safety Barrier.

Module XIII. Truck-Mounted Attenuator

INSTRUCTION SUMMARY

Duration:

10 minutes

Objective:

To cover history, application, and inspection of truck-mounted attenuators

Content:

TCP Compliance, Delineation, Damaged TMA's, TMA Operation

Equipment:

VCR

Aids:

9 minute Videotape

PRESENTATION OPTIONS

The videotape for this module is 9 minutes, so little additional time is available. The checklist can be covered as a summary. If the video is not used, overheads of manufacturers' literature could be substituted.

LESSON PLAN

Introduction

- TMA's, protect errant vehicle occupants and shadow vehicle drivers

Use has become more prevalent due to effectiveness

Video

Produced by Energy Absorption

Covers history and effectiveness

- Other brands include Hexcel and Connecticut

Summary

- Highback seats are important

Spacing is shown in notebook

- Weight of shadow vehicle should be 4,500 to 10,000 kilograms (10,000 to 22,000 pounds)

VISUAL AIDS

9:12 videotape produced by Energy Absorption "Introduction to TMA's."

Module XIII. Truck-Mounted Attenuator

Participant's Notebook Text INTRODUCTION

Visual Aids
Video - "Introduction to TMA's", 9 minutes

Truck-mounted attenuators (TMAs) have become commonplace in work zones. A wide variety of models, manufacturers, and configurations of TMAs are now available to highway agencies for use. Their safety features and usefulness have allowed them to perform spectacularly in some work zone accidents. However, they do add another item to the work zone inspector's list of devices that must be regularly checked and inspected for proper functioning. Some of the main points common to nearly all TMAs are discussed below.

Is the TMA installed according to the plans and specifications, or the manufacturer's recommendations, as appropriate?

Are the number of protective vehicles specified by the TCP available for use?

Check to ensure that the TMA is installed according to the plans and specifications. Also, the TCP should specify the number of protective vehicles equipped with TMAs that are available for use in the work zone. Observe to ensure that the correct number of vehicles are being used, or are available for use.

Is the TMA properly delineated?

TMAs are normally delineated with a variety of compact reflective elements. Also, TMAs are usually colored with a set of alternating black and yellow stripes sloping downward from the middle of the back of the TMA to indicate the direction in which traffic is to pass. This arrangement is shown in figure 13-1. Often, vehicles equipped with TMAs are at the rear of a moving train of vehicles, and should hence be equipped with warning signs, arrow panels, or other traffic control devices. Check the TCP to see if these devices are required, and if so, inspect them to ensure that they send the proper message to motorists and are in good operating condition.

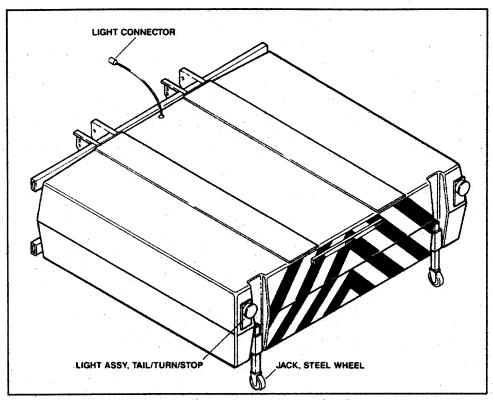


Figure 13-1. Proper Delineation for TMAs.

Is there existing damage to the TMA?

Often, accidental backing maneuvers, a low-speed impact, or a glancing blow on the TMA can damage the TMA, but leave it largely intact. This can result in an unsafe operation, as the TMA does not still possess its full specified energy-absorbing capacity. Note, however, that some TMAs have a bumper section which can appear damaged, but the TMA is still perfectly capable of performing properly. Check the TCP for information on the TMA type used, and determine if the damage done is only to this section. If there is any question about the suitability of the TMA for use, report the damaged TMA to the project engineer to ensure that it is acceptable for use on the project.

Are proper high-back seats, shoulder harnesses, and hard hats used by drivers of protective vehicles?

Safety measures are important on TMA vehicles. The TMA is effective in reducing the severity of accidents involving these vehicles, but there are still chances of injury to involved persons. The protective vehicles should be checked to see that the driver is using proper high-back seats, shoulder harnesses, and hard hats.

Are proper operating procedures used for the type of traffic control operation: short-term stationary, mobile, or moving? Is the TMA in the upright position when traveling to the work zone?

Check to see that the proper operating procedures for the TMA are being used according to the TCP. Depending on the complexity of the project and the TCP, different operating procedures may be required based on the type of traffic control and type of operation. Also, observe the operation to ensure that the TMA is maintained in the upright position while traveling to and from the work zone.

Is the TMA operation adversely affecting traffic: traffic backup, near misses, motorist complaints?

In TMA operations, it is possible for the work activity to interfere with the traffic around it. Some level of impediment may be tolerated, but when the level of conflicts caused by the operation reaches an extreme, the safety of the operation may be compromised. Check to ensure that there is not an inordinate amount of traffic backup, "near-miss" accidents, or motorist complaints that might indicate a serious problem.

Where the truck employing the TMA is parked, is it in gear with the brakes set? Is the TMA connected securely to the vehicle?

In stationary operations, the protective vehicle should be parked. It is important that the front wheels of the vehicle be turned so that any roll-ahead of the TMA vehicle will steer it away from the work site or back out into the traffic lane. Also, check to ensure that the TMA is securely attached to the protective vehicle with manufacturer-approved hardware. The system will obviously not perform as designed if the mass of the protective vehicle is not used to dissipate some kinetic energy or if insecure mooring causes the TMA itself to fly off in an impact.

Is a sufficient roll-ahead distance maintained between the protective vehicle and the work area?

The distance between the protected work area and the TMA vehicle should be checked that it is sufficient for the roll-ahead that occurs in TMA impacts. Also, the distance must be small enough to prevent drivers from going around the TMA vehicle and striking workers. Table 13-1 on the next page gives some guidelines on shadow (TMA) vehicle spacing.

Table 13-1. Recommended guidelines for spacing of shadow vehicles.

	Recommended Spacing			
Operating Speed	For Shadow Vehicles Weighing 10,000 kilograms (22,000 pounds) or More		For Shadow Vehicles Weighing 4,500 to 10,000 kilograms (10,000 to 22,000 pounds)	
	Stationary	Moving	Stationary	Moving
	Operation	Operation	Operation	Operation
< 70 kilometers per hour	22.5 meters	30 meters	30 meters	30 meters
(45 miles per hour)	(75 feet)	(100 feet)	(100 feet)	(100 feet)
70-90 kilometers per hour (45-	30 meters	45 meters	37.5 meters (123 feet)	52.5 meters
55 miles per hour)	(100 feet)	(150 feet)		(170 feet)
> 90 kilometers per hour	45 meters	52.5 meters	52.5 meters	67.5 meters
(55 miles per hour)	(150 feet)	(170 feet)	(170 feet)	(220 feet)

INSPECTION CHECKLIST -- Truck Mounted Attenuator

Date Inspected:/ Inspector:			
Loc	ation of Device: Mile Post and Roadway or Job Number		*****
Any	questions anwered NO should be discussed with supervisor.	YES	NC
1.	Is the TMA installed according to the plans and specifications or the manufacturer's recommendations, as appropriate?	· · ·	-
2.	Are the number of protective vehicles specified by the TCP available for use?		<u> </u>
3.	Is the TMA properly delineated?		
4.	Is there existing damage to the TMA?		
5.	Are proper high-back seats, shoulder harnesses, and hard hats used by drivers of protective vehicles?		
6.	Are proper operating procedures used for the type of traffic control operation: short-term stationary, mobile, or moving?		
7.	Is the TMA in the upright position when traveling to the work zone?		
8.	Is the TMA operation adversely affecting traffic: traffic backup, near misses, motorist complaints?		-
9.	Where the truck employing the TMA is parked, is it in gear with the brakes set?		-
10.	Is the TMA connected securely to the vehicle?		
11.	Is a sufficient roll-ahead distance maintained between the protective vehicle and the work area?		
	For questions answered NO, state the question number and problem:		
	G. A. I. VIO		
	State the action resulting from questions answered NO:		
Tin	ne and date that the problem was resolved:		
Sign	nature and Title:		

Module XIV. Second Inspection Workshop and Course Summary

INSTRUCTION SUMMARY

Duration:

90 minutes

Part 1, "Field Inspection Workshop Problems" - 45 minutes

Part 2, "Presentation of Results" - 45 minutes

Objective:

To give course participants the opportunity to apply what they have learned about

inspection techniques, and, to the extent possible, to carry the classroom instruction

over to "real-world" application

Content:

Inspection techniques, group field inspection, presentation of results, summary of

course

Equipment:

Overhead Projector

Aids:

Handout with instructions to workshop participants.

Photographs and overheads covering arrow panels, signs, sign mounting, impact

attenuators, pavement markings, and barriers

PRESENTATION OPTIONS

For this workshop, each team should normally consider 4 to 6 photographs. Photographs pertaining to devices covered in modules that were not included in the classroom instruction should not be distributed to the teams as workshop problems. For example, if the arrow panel module was not requested by the sponsoring agency, and no presentation has therefore been made concerning arrow panels, the arrow panel photos should be excluded from this workshop. The visual aids section of this instruction summary, below, is a valuable guide to selecting which problems should be omitted based on the modules presented.

LESSON PLAN

PART 1 - FIELD INSPECTION WORKSHOP PROBLEMS

Workshop problems are presented to teams of inspectors. Photographs of actual work zone devices, safety hardware, and conditions are provided. Questions are asked about the photographs. Participants use their inspector checklists, participant's notebook, Department standards, and the MUTCD to answer the questions. Thirty-four photographs are used to practice inspection procedures of the following six inspection items: arrow panels, channelizing devices, impact attenuators, pavement markings, portable concrete barrier, and signing. Teams summarize the results

of the inspection and develop conclusions of the inspection and recommended actions to correct any problems.

PART 2 - PRESENTATION OF RESULTS

The teams present solutions to the problems. Overhead projections of the photographs are shown while participants discuss and present the solutions. Recommended actions are presented.

SUMMARY

Handons

After the presentations by the team leaders, a summary of the course content and recommended inspection procedures should be presented. An overhead of the specific course agenda created makes an excellent visual aid from which to base the presentation of summary information. Alternately, custom word slides or overheads could be created to summarize the course content.

A few of the more important points of the course should be highlighted:

- MUTCD Part VI contains minimum standards
- ATSSA Quality Standards are a useful tool to inspectors
- Emphasis on quality assurance of work zone traffic control and safety devices
- Importance of inspecting nighttime traffic control for adequate visibility
- Discrepancies versus deficiencies

VISUAL AIDS

Contents
Instructions to workshop participants
Inspections Items Covered
Arrow Panels
Arrow Panels, Channelizing Devices
Pavement Markings
Pavement Markings
Sand Barrel Attenuator
Sand Barrel Attenuator
GREAT CZ
GREAT CZ
GREAT CZ
Drums and Sheeting

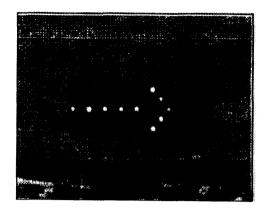
10	Drums
11	Drums
12	Drums
13	Drums
14	Vertical Panels, Drop-offs
15	Drums, Barricades, and Warning Lights
16	Sign Mounting
17	Signs
18	Sign Mounting
19	Signs and Sign Mounting
20	Signs and Sign Mounting
21	Sign Mounting
22	Sign Mounting
23	Drums, Drop-offs
24	Signs, Drums, Drop-offs
25	Barricades, Signs, and Warning Lights
26	Barricades
27	Portable Concrete Barrier
28	Portable Concrete Barrier
28	Portable Concrete Barrier
30	Portable Concrete Barrier
31	Portable Concrete Barrier
32	Portable Concrete Barrier, Object Markers, and Impact Attenuators
33	Portable Concrete Barrier, Object Markers, and Impact Attenuators

SECOND INSPECTION WORKSHOP

Instructions to Workshop Participants

The pictures being distributed show conditions of specific features in the field at your project. Use your notebook, plans, standard specifications, and special provisions to answer the questions on the back of the pictures.

Note: The photos may not be the exact feature that you saw on the video, but accept it as that feature with your group.



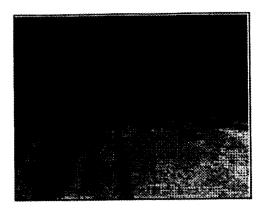
1. Flashing arrow panel with right arrow

Assumptions:

High-speed, high volume roadway

Stationary left lane closure

- 1. What should be the height and width of the arrow panel?
- 2. Is the arrow panel a Type A, Type B, or Type C?
- 3. What is the minimum mounting height for this type of arrow panel?
- 4. What should be the "minimum legibility distance?"
- 5. What does "minimum legibility distance" mean?
- 6. Which direction should the arrow be pointing left or right?
- 7. In terms of "quality," is the arrow panel "acceptable," "marginal," or "unacceptable?"
- 8. What is required for this arrow panel to be used at night?



1. A. SR 291 looking north from the US 24 bridge

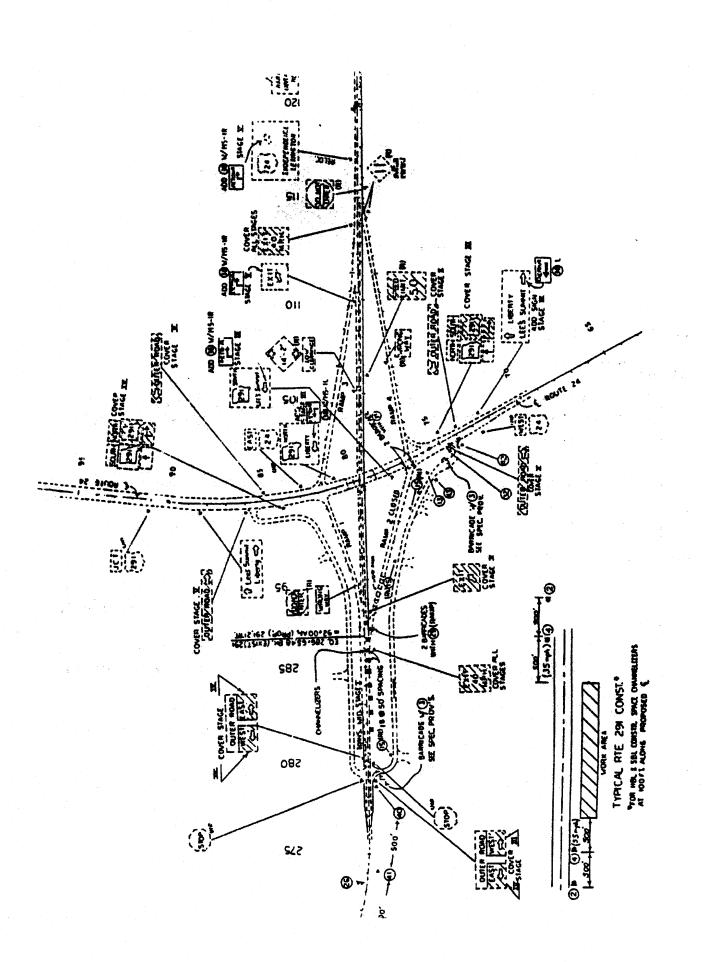
Assumptions:

You have just been assigned to be the inspector on this project, which has been in progress for 3 months.

You are standing on the US 24 bridge looking north along SR 291.

You are working from the attached traffic control plan.

- 1. According to the traffic control plan, is the arrow panel required on this project?
- 2. Explain how you would determine how the arrow panel came to be used on this project.
- 3. What should be the typical spacing (in feet) of the channelizers/drums along SR 291?

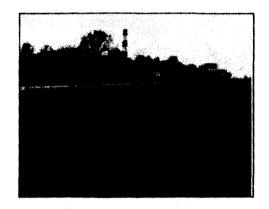




2. Undivided multilane road showing traffic and pavement markings Assumption:

Long-term construction project - at least 6 months

- 1. What is the quality of these pavement markings? Explain.
- 2. What should be the color of the solid lines?
- 3. What should be the color of the dashed lines?
- 4. What should be the length of each dash and the spacing between dashes?

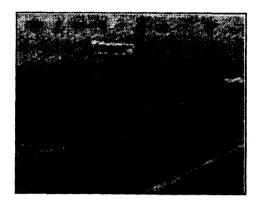


3. Divided freeway without full markings

Assumptions:

Freeway with two lanes in each direction Dashed lines have been place for 7 days Each dash is 4 feet in length

- 1. Are these pavement markings known as "permanent" or "interim"?
- 2. Based on the type of marking, "permanent" or "interim," what should be the cycle length—the distance from the start of one dash to the start of the next dash?
- 3. If "interim" markings are used in a construction zone, how long may they remain in place before "permanent" markings are required to be installed?
- 4. What color of marking should be installed along the left edgeline? Why?
- 5. What color of marking should be installed along the right edgeline? Why?



4. Four-lane divided freeway with safety-shaped barrier and sand barrels

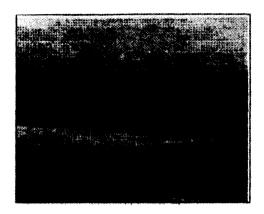
Assumptions:

Divided freeway with two lanes in each direction

Normal speed limit = 65 mph

Work zone speed limit = 45 mph

- 1. Why are there sand barrels on each end of the barrier?
- 2. What should be the design speed of the sand barrel array 65 mph or 45 mph? Why?
- 3. The sand barrel array should be rotated toward the approaching traffic a maximum of how many degrees?
- 4. Are the sand barrel arrays rotated within the allowable limit? How can you determine the proper rotation angle?



5. Sand barrel array

Assumptions:

Four-lane divided freeway with sand barrel array at the end of safety-shaped barrier

Normal speed limit = 65 mph

Work zone speed limit = 45 mph

- 1. What is the design speed of the sand barrel array?
- 2. Does the sand barrel array comply with the "detail for impact attenuator?" Explain why or why not.
- 3. How do you determine how much each sand barrel weighs?



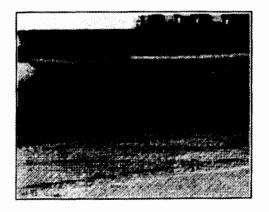
6. G-R-E-A-T cz

Assumptions:

Six bays plus a nose section

May be impacted from either direction

- 1. Is this G-R-E-A-T cz designed for a low-speed application or a high-speed application?
- 2. How many hex foam cartridges are required?
- 3. What is a transition plate?
- 4. Is a transition plate required on this G-R-E-A-T cz?



7. Front sections of G-R-E-A-T cz

Assumptions:

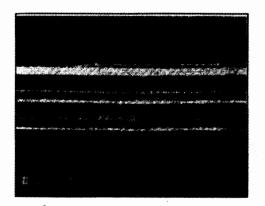
Six bays plus a nose section

May be impacted from either direction

Questions:

- 1. The bolts should be loose so that the fender panels can easily slide when impacted--true or false?
- 2. Why should the area underneath the G-R-E-A-Tcz be free from debris? Give two reasons.
- 3. The anchor chains should be installed over the chain pegs. Which direction should the chain pegs be facing?

Why?



8. Center sections of G-R-E-A-T cz

Assumptions:

Six bays plus a nose section

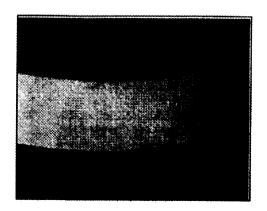
May be impacted from either direction

Questions:

- 1. In what direction is the front of the G-R-E-A-T cz--left or right in the photo?
- 2. Is the rock in the photo helping or hurting the G-R-E-A-T cz's function?

Why?

- 3. What is the purpose of the cable guide system?
- 4. If the G-R-E-A-T cz is installed on asphalt with an 8-inch depth, what kind of base is required?
 - a. 3-inch concrete base.
 - b. 6-inch compacted base.
 - c. No base is required.
 - d. None of the above.



9. Close-up view of retroreflective sheeting on the drum

Assumption:

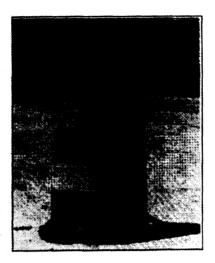
This drum has been specified by your Department.

Questions:

- 1. What type of retroreflective sheeting should be installed on this drum?
- 2. What are the minimum dimensions of the drums specified by your Department?

Width/diameter (inches)?

Height (inches)?



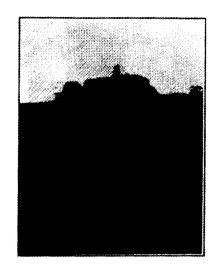
10. Closeup view of drum

Assumption:

This drum has been specified by your Department.

Questions:

- 1. Is the "quality" of this drum acceptable, marginal, or unacceptable?
- 2. What would you do if 80 percent of the drums on your project were of this "quality?"



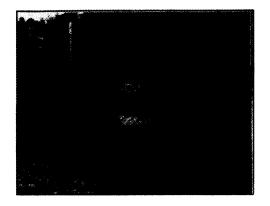
11. Closeup view of drum with traffic in the background

Assumption:

This drum has been specified by your Department.

Questions:

- 1. Is the "quality" of this drum acceptable, marginal, or unacceptable?
- 2. What would you do if 80 percent of the drums on your project were of this "quality?"



12. Closeup view of drums with delineators in the background

Assumption:

This drum has been specified by your Department.

Questions:

- 1. Is the "quality" of this drum acceptable, marginal, or unacceptable?
- 2. What would you do if 80 percent of the drums on your project were of this "quality?"



13. View of array of drums

Assumption:

This type of drum has been specified by your Department.

Question:

Stage Stage Stage

1. Is the "quality" of this array of drums acceptable, marginal, or unacceptable?



14. View of an array of vertical panels/ object markers

Assumptions:

These vertical panels/object markers have been specified by your Department.

There is a 3-inch dropoff at the edge of the shoulder.

Questions:

- 1. What is the "quality" of these vertical panels/object markers?
- 2. What would you do if 80 percent of these vertical panels/object markers on your project were of this "quality?"
- 3. What is the minimum mounting height from the bottom of the sign to the pavement?
- 4. For the condition of the roadside at the edge of the shoulder, what is your Department's drop off policy require you to do in terms of signing, other traffic control devices, and protection?

tratifc is maintained through the temporary traffic control zone. They may be used singly or in groups to mark a specific condition, or they may be used in a series for channelizing traffic. Type I barricades normally would be used on conventional roads or urban streets and arterials. Type II barricades have more retroreflective area and are intended for use on expressways and freeways or other high-speed roadways.

Type III barricades used at a road closure may extend completely across a roadway or from curb to curb. Where provision is made for access of authorized equipment and vehicles, the responsibility for the Type III barricades should be assigned to a person to ensure proper closure at the end of each work day.

When a highway is legally closed but access must still be allowed for local traffic, the Type III barricade should not be extended completely across a readway. A sign with the appropriate legand concerning permissible use by local traffic shall be mounted. (See section 6F-1.a.5.)

Signs may be erected on barricades, particularly those of the fixed type, that offer a most advantageous facility for this purpose. The ROAD CLOSED and DETOUR ARROW signs, and the LARGE ARROW warning signs, for example, can be mounted effectively on or above the barricade that closes the roadway.

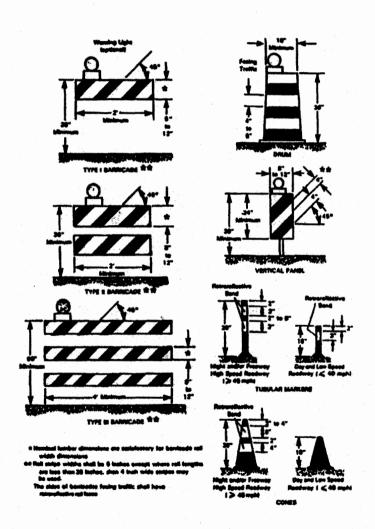
g. Portable Barriera

The need for portable barriers should be determined by engineering analysis and the protective requirements of the location, not the channelizing needs. They should be designed according to chapter 9 of the AASHTO Roadside Design Guide.¹⁹

When serving the additional function of channelizing traffic, the barrier taper shall meet standard channelizing taper lengths. The channelizing barrier shall be supplemented by standard delineators, channelizing devices, or pevernent markings. Channelizing barriers should not be used for a merging taper except in low-speed urban areas.

h. Temporary Raised Islands

The temporary raised island should only be used on roadways with speeds of 45 mph or less except when recommended by an engineering study.



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15. Closed off-ramp with drums and barricade

Assumptions:

Long-term construction project lasting at least six months.

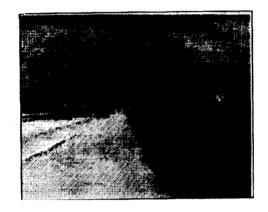
The off-ramp is closed to traffic.

All devices are specified by your department.

Questions:

1. Is the "quality" of the array of drums acceptable, marginal, or unacceptable?

- 2. According to your Department's policy, how often should you inspect the work zone's traffic controls and hardware?
- 3. If you saw this scene while doing your inspection, what would you do?
- 4. The barricade in the scene is a Type I, Type II, or Type III barricade?
- 5. Because of the way the stripes on the barricade slope downward, on which side of the barricade should drivers pass in the photoleft or right?
- 6. What type of warning lights should be on top of the barricade? Why?



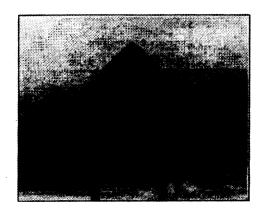
16. Road Construction Ahead sign on freeway

Assumptions:

Urban freeway

48-inch ROAD CONSTRUCTION AHEAD sign

- 1. According to your Department's sign mounting requirements, what should the sign's mounting height and lateral offset distance be?
- 2. Does this sign meet your Department's sign mounting requirements? Explain.



17. Closeup of Road Construction Ahead sign

Assumptions:

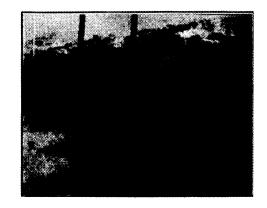
Urban freeway

American State of the

48-inch ROAD CONSTRUCTION AHEAD sign

Question:

1. What is the "quality" of the ROAD CONSTRUCTION AHEAD sign - "acceptable," "marginal," or "unacceptable?"



18. Close-up of supports and bracing on the Road Construction Ahead sign Assumptions:

Urban freeway

48-inch ROAD CONSTRUCTION AHEAD sign

- 1. What is your Department's policy on "bracing?"
- 2. Is the sign braced according to your Department's policy?
- 3. If these sign supports were spliced (main sign supports bolted to the stubs driven into the ground), what is the permissible height of the splice (stub)?



19. Closeup of Road Construction Ahead sign on an urban arterial

Assumptions:

Urban arterial

48-inch ROAD CONSTRUCTION AHEAD sign

- 1. What is the "quality" of this ROAD CONSTRUCTION AHEAD sign "acceptable," "marginal," or "unacceptable?"
- 2. According to your Department's sign mounting requirements, what should be the sign's mounting height and lateral offset distance?
- 3. Does this sign meet your Department's sign mounting requirements? Explain.



20. Right reverse turn sign with 30 mph advisory speed plate and 50 mph regulatory speed limit sign

Assumptions:

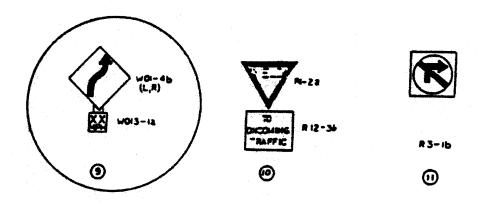
Urban arterial

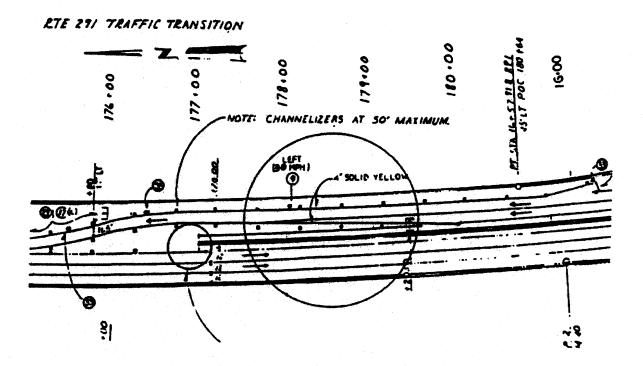
48-inch warning sign with 24-inch advisory speed plate

Questions:

- 1. What is the "quality" of the orange construction signs "acceptable," "marginal," or "unacceptable?"
- 2. According to your Department's sign mounting requirements, what should be the sign's mounting height and lateral offset distance?
- 3. Does this sign meet your Department's sign mounting requirements? Explain.
- 4. What is the "enforceable" speed limit?
- 5. What liability problems could arise from posting the two conflicting speed limits shown? Explain.
- 6. Discuss placement of the "advisory" speed limit sign since the "regulatory" speed limit was already in place when the project started.
- 7. Go to station 178+00 on the traffic control plan (TCP). According to the TCP, what sign is specified?

Does the sign installed on the project (shown in the photo) correspond to the sign shown in the TCP? Explain.







21. Sign supports for the right reverse turn sign with 30 mph advisory speed plate and 50 mph regulatory speed limit sign

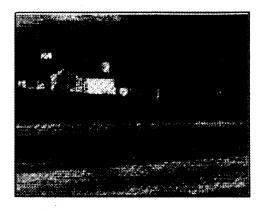
Assumptions:

Urban arterial

48-inch warning sign with 24-inch advisory speed plate

Questions:

- 1. Examine the sign support splices (main sign supports bolted to the stubs driven into the ground). What is the permissible height of the splice (stub)?
- 2. Does the splice meet your Department's requirements?



22. Back view of a regulatory speed limit sign

Assumptions:

Urban freeway

48- by 60 inch regulatory speed limit sign

Speed limit = 45 mph

- 1. According to your Department's sign mounting requirements, what should be the sign's mounting height and lateral offset distance?
- 2. Does this sign meet your Department's sign mounting requirements? Explain.
- 3. Is the sign braced according to your Department's policy?
- 4. If these sign supports were spliced (main sign supports bolted to the stubs driven into the ground), what is the permissible height of the splice (stub)?



23. Excavation with OPEN TRENCH sign and drums

Assumptions:

Urban arterial

45-mph speed limit

Long-term construction project of at least 6 months duration

There is an 8-inch drop off at the edge of the excavation.

The excavation is adjacent to the lane open to traffic.

- 1. For the drop off condition shown, what is your Department's drop off policy require you to do in terms of signing, other traffic control devices, and protection?
- 2. Does the traffic controls shown (drums) meet your Department's drop off policy? Explain.

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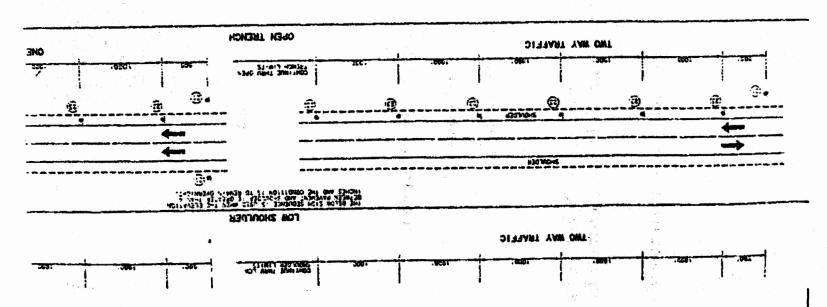
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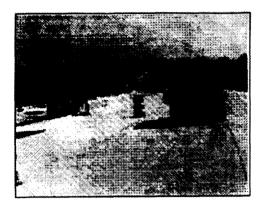
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74: 183125418 2303 18383444 36108 774

CONDITION



4-31



24. Excavation with drums

Assumptions:

Urban arterial

45-mph speed limit

Long-term construction project of at least 6 months duration

There is an 8-inch drop off at the edge of the excavation.

The excavation is separated by a width of one lane from the lane open to traffic.

- 1. For the drop off condition shown, what is your Department's drop off policy require you to do in terms of signing, other traffic control devices, and protection?
- 2. Does the traffic controls shown (signing and drums) meet your Department's drop off policy? Explain.

TWO WAY TRAFFIC

LOW SHOULDER

4-33



25. Type III barricade (movable barricade) with large arrow- and ROAD CLOSED signs

Assumptions:

Urban arterial with a 45 mph speed limit

The top rail of the barricade is 7 feet off of the ground.

Questions:

- 1. The orange and white diagonal stripes slope downward and to the left.
 - a. What does this mean?
 - b. Are the stripes in the proper direction?
- 2. How many rails is a Type III barricade required to have?
- 3. Is the top rail of the barricade within the proper mounting height requirements?
- 4. Are the orange and white sand bags on the bottom of the barricade being properly used as "ballast?" Explain.
- 5. What type of warning lights should be on top of the barricade? Why?
- 6. Go to station 176+00 on the traffic control plan (TCP). According to the TCP, what signs are specified?

Do the signs installed on the project (shown in the photo) correspond to the sign shown in the TCP? Explain.





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ROAD

MO4- 10 (L.R) **(7)** *

NOTE:

Q MOUNT ON BARRICADE ONE FOOT ABOY TOP

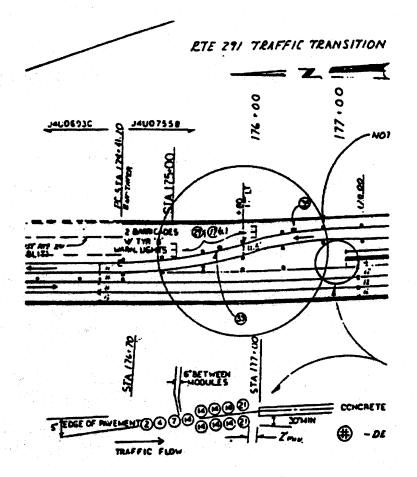
AND WITH TIPE 'E' WARNING LIGHTS.

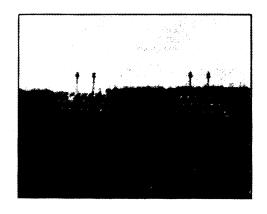
ALL SIGHS SMALL BE ON PORTABLE MOUNTS UNLESS

LABLED 'NP' (NOMPORTABLE) WHICH SHALL BE
PLACED AT THE START OF CONSTRUCTION AND
REMAIN THRU THE DURATION OF THE PROJECT,

SIGHS FOR OFERHIENT OPERATION SHALL ASE BE
MONTGETABLE. MYMENT WILL BE MADE FOR

RELOGATION.





26. Two Type III barricades

Assumptions:

Urban freeway with a 45-mph speed limit

Closed off ramp

Questions:

- 1. What do the orange and white diagonal stripes that slope downward to the left mean?
- 2. What are the width (vertical dimension) requirements of the individual barricade rails?
- 3. The Type III barricades do not completely block the closed off ramp. Should an additional Type III barricade have been used?

Why or why not?

traffic is maintained through the temporary traffic control zone. They may be used singly or in groups to mark a specific condition, or they may be used in a series for channelizing traffic. Type I barricades normally would be used on conventional roads or urban streets and artefals. Type II barricades have more retroreflective area and are intended for use on expressways and freeways or other high-speed roadways.

Type III barricades used at a road closure may extend completely across a roadway or from curb to curb. Where provision is made for access of authorized equipment and vehicles, the responsibility for the Type III barricades should be assigned to a person to ensure proper closure at the end of each work day.

When a highway is legally closed but access must still be allowed for local traffic, the Type III barricade should not be extended completely across a roadway. A sign with the appropriate legend concerning permissible use by local traffic shall be mounted. (See section 6F-1.a.5.)

Signs may be erected on barricades, particularly those of the fixed type, that offer a most advantageous facility for this purpose. The ROAD CLOSED and DETOUR ARROW signs, and the LARGE ARROW warning signs, for example, can be mounted effectively on or above the barricade that closes the roadway.

g. Portable Barriers

The need for portable barriers should be determined by engineering analysis and the protective requirements of the location, not the channelizing needs. They should be designed according to chapter 9 of the AASHTO Roadside Design Guide.*

When serving the additional function of channelizing traffic, the barrier taper shall meet standard channelizing taper lengths. The channelizing barrier shall be supplemented by standard delineators, channelizing devices, or pavement markings. Channelizing barriers should not be used for a merging taper except in low-speed urban areas.

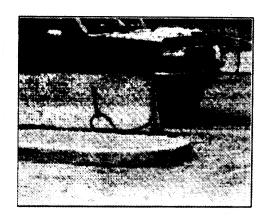
Temporary Raised Islands

The temporary raised island should only be used on roadways with speeds of 45 mph or less except when recommended by an engineering study.

"AASHTO, 444 North Caphol Street, N.W., Subs 225, Washington, D.C. 2000

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14-37



27. Portable concrete barrier (PCB) adjacent to raised island

Assumptions:

Urban arterial with a 35-mph speed limit

Traffic on either side of the barrier is going in the same direction.

- 1. Should the PCB have an impact attenuator at the end of it?

 Why or why not?
- 2. Are the PCB sections required to have delineators according to your Department's policy?
- 3. Is the cable that connects the PCB sections properly anchored? Explain.



28. Close up view of two sections of portable concrete barrier (PCB) Assumptions:

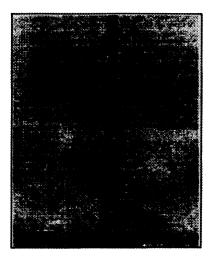
Urban arterial with a 45-mph speed limit

There is a 3-inch gap between the two barrier sections

Question:

1. Is a cover plate required between the two barrier sections?

Why or why not?



29. Close up view of lower portions of two sections of portable concrete barrier (PCB) with a broken corner.

Assumption:

Urban arterial with a 45-mph speed limit

- 1. Does the broken corner mean that the barrier is "unacceptable" if:
 - a. The broken corner was discovered while performing an inspection on the job site? Why?
 - b. The broken corner was discovered while performing an inspection at the barrier storage facility? Why?
- 2. What would you do if the barrier was determined to be "unacceptable" in either question 1a or 1b?



30. Close up view of lower portions of two sections of portable concrete barrier (PCB) with a cracked corner that is spalling.

Assumption:

Urban arterial with a 45-mph speed limit

- 1. Does the cracked and spalled corner mean that the barrier is "unacceptable" if:
 - a. The cracked corner was discovered while performing an inspection on the job site? Why?
 - b. The crack corner was discovered while performing an inspection at the barrier storage facility? Why?
- 2. What would you do if the barrier was determined to be "unacceptable" in either question 1a or 1b?
- 3. If the bottom section was required to be painted according to the traffic control plans, what should be the height of the painted area?



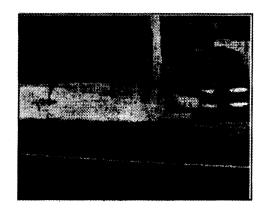
31. Precast barrier height transition

Assumptions:

Urban arterial with a 45-mph speed limit

The barrier separates opposing directions of traffic.

- 1. According to Department standards, what is the required length of the barrier height transition?
- 2. Does the barrier height transition meet Department standards? How can you tell without measuring the section?



32. Two sections of barrier with barrier height transitions

Assumptions:

Urban arterial with a 35-mph speed limit

Traffic on either side of the barrier is traveling in the same direction.

Lane width of each lane on either side of the barrier is 11 feet.

- 1. According to Department standards, what is the required length of the barrier height transition?
- 2. Does the barrier height transition meet Department standards? How can you tell without measuring the section?
- 3. According to the MUTCD, what are the red diamond-shaped signs called?
- 4. According to Department standards, are the red signs properly used in this situation?
- 5. Is an impact attenuator required at this installation? Why or why not?
- 6. According to Department standards, is the barrier height transition required to be connected to the other barrier sections? Explain.



33. Two sections of barrier with barrier height transitions.

Assumptions:

You are working from the attached traffic control plan (TCP) and MUTCD.

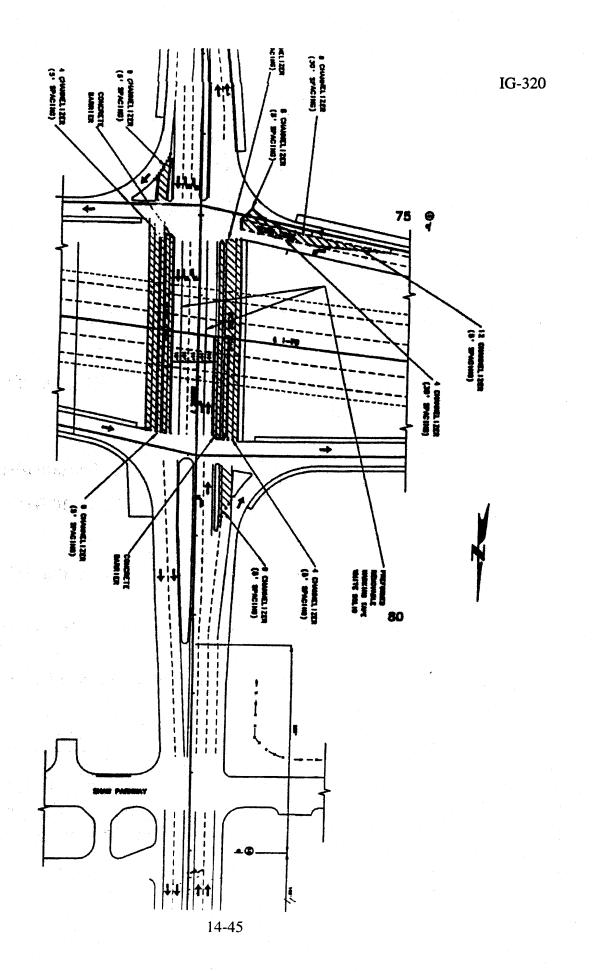
Urban arterial with a 35-mph speed limit

Traffic on either side of the barrier is traveling in the same direction.

Lane width of each lane on either side of the barrier is 10 feet.

- 1. According to Department standards, what is the required length of the barrier height transition?
- 2. According to the TCP, are the red diamond-shaped signs required?
- 3. According to the MUTCD, what are the red diamond-shaped signs called?
- 4. Assume that the diamond-shaped signs are required. According to Department standards, what should be the color of the signs?
- 5. Is an impact attenuator required at this installation?
- 6. According to Department standards, is the barrier height transition required to be connected to the other barrier sections?

 Explain.



For additional emphasis, a large surface such as a bridge pier may be painted with diagonal stripes, 12 inches or greater in width, similar in design to the Type 3 object marker. The alternating black and reflectorized yellow stripes shall be sloped down at an angle of 45° toward the side of the obstruction which traffic is to pass.

Appropriate signs (sees. 2B-25 and 2C-33) directing traffic to one or warning of approach to the obstruction shall be given by appropriate both sides of the obstruction may be used in lieu of the object marker. In addition to markings on the face of an obstruction in the roadway, pavement markings (sec. 3B-13).

Where the vertical clearance of an overhead structure exceeds the maximum legal height of vehicle by less than one foot, the clearance in feet and inches should be clearly marked on the structure (sec. 2C-34),

3C-3 Objects Adjacent to the Roadway

Objects not actually in the roadway may be so close to the edge of the road that they need a marker. These include underpass piers, bridge abutments, handralls and cuivert headwalls. In some cases there may not be a physical object involved, but other roadside conditions such as narrow shoulder drop-offs, gores, small islands and abrupt changes in the roadway alignment may make it undesirable for a driver to leave the rondway. Type 2 or 3 object markers are intended for use at such locations. The inside edge of the marker shall be in line with the inner edge of the obstruction.

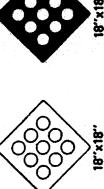
Standard warning signs (Part II-C) should also be used where applicable. Typical applications of markers for roadside obstructions are shown in figure 3-20.

3C-4 End of Roadway

When it is determined that markers should be placed at the end of a roadway where there is no alternate vehicular path, either a marker More than one marker or a larger marker may be used at the end of the roadway where conditions warrant. The minimum mounting height of this consisting of nine red reflectors, each with a minimum dimension of approximately 3", mounted symmetrically on an 18-inch diamond, red or black panel; or an 18-inch diamond reflectorized red panel shall be used. marker shall be four feet. Appropriate advance warning signs should be

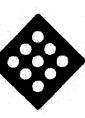
P. C. C.

Typical Type 1 Object Markers



MI-23 (4

M-7 (c)















Typical Type 2 Object Markers

000 12"x6"

8"×12"

Typical Type 3 Object Markers





12'x36'

Change Change Fr. 29

Typical End of Road Markers

18"×18"

18"×18"

18"×18"

IG-321

Module XIV. Second Inspection Workshop and Summary

Participant's Notebook Text SECOND INSPECTION WORKSHOP

In this workshop, you will conduct a mock inspection of the work zone that you have reviewed and have been provided TCPs for. Photographs of the site will show you the conditions you encounter on your on-site "inspection." You are to record on appropriate forms the results of your daytime inspections. Also, note other information you would have collected in the field that is not available from these photos.

SUMMARY

This course has presented an overview of what it takes to be a good inspector, as well as the things that an inspector should look for when inspecting the safety aspects of a work zone.

The first part of the course delved into standards concerning work zone safety devices. The FHWA MUTCD Part VI contains minimum standards. Information was presented that showed that, in many cases, it is better to exceed these minimum standards in order to provide a safer work zone. Night time visibility of work zones is an important factor to consider when inspecting work zones for quality of devices. The ATSSA Quality Standards handed out with your notebook is a valuable guide to determine the quality of an installed work zone traffic control device.

The course also discussed the importance of recognizing discrepancies and deficiencies, and how to go about correcting them. We discussed how other safety devices, such as impact attenuators and barriers, have a different set of criteria for inspecting their quality and utility.

Finally, the course workshops have hopefully provided you, the participants, with the opportunity to see how the material in this course applies to devices on the road. While it is not possible to have every cone in place or every device 100 percent clean for nighttime visibility purposes, it is important to see when the number or severity of these types of deficiencies is capable of causing serious hazards to motorists and workers. And as a work zone safety inspector, it is your duty to recognize them.

Visual Aids

H14-1 Instructions to workshop participants

Photographs presenting workshop problems (1-33, minus photos not covered in classroom instruction

Appendix A. For More Information

A wide variety of devices and inspection procedures have been presented in this notebook. The following are excellent sources if you wish to seek additional information.

Module II.B. Inspection Procedures

1. New York State Department of Transportation, (1992, April 13) Engineering Instruction, no. EI-92-D17. "Contractor Compliance with Health and Safety Requirements, and Other Contract Provisions," Albany, NY.

Module III.A. Reflective Sign Sheeting

- 1. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.
- 2. American Traffic Safety Services Association (ATSSA), "ATSSA Quality Standards for Work Zone Traffic Control Devices," American Traffic Safety Services Association, Fredricksburg, VA.

Module IV. Flagger/Devices

- 1. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.
- 2. American Traffic Safety Services Association (ATSSA), "Flagger's Handbook," American Traffic Safety Services Association, Fredricksburg, VA.

Module V. Signs

- 1. Woods, Donald L., Charles Pinnell, and Beverly A. Thompson, 1989 (August), "A Short Course on Inspection of Construction Zone Safety Hardware," Participant's Workbook.
- 2. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.

3. American Association of State Highway and Transportation Officials (AASHTO), 1988 (October), "Roadside Design Guide," AASHTO, Washington, DC.

Module V.A. Sign Supports

- 1. Woods, Donald L., Charles Pinnell, and Beverly A. Thompson, 1989 (August), "A Short Course on Inspection of Construction Zone Safety Hardware," Participant's Workbook.
- 2. American Association of State Highway and Transportation Officials (AASHTO), 1988 (October), "Roadside Design Guide," AASHTO, Washington, DC.

Module VI. Portable Changeable Message Signs

- 1. Blume, Jayne, "Inspector's Training Manual for Traffic Control Through Construction," Participant's Notebook, Texas State Department of Highways and Public Transportation
- 2. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.

Module VII. Arrow Panels

- 1. Blume, Jayne, "Inspector's Training Manual for Traffic Control Through Construction," Participant's Notebook, Texas State Department of Highways and Public Transportation
- 2. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.

Module VIII.A. Cones

1. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.

5. American Association of State Highway and Transportation Officials (AASHTO), 1988 (October), Roadside Design Guide, AASHTO, Washington, DC.

Module VIII.F. Portable Barrier

1. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.

Module VIII.G. Temporary Raised Island

- 1. American Association of State Highway and Transportation Officials (AASHTO), 1988 (October), "Roadside Design Guide," AASHTO, Washington, DC.
- Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.

Module IX.B. Interim Markings

- 1. American Traffic Safety Services Association (ATSSA), "ATSSA Quality Standards for Work Zone Traffic Control Devices," American Traffic Safety Services Association, Fredricksburg, VA.
- 2. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.

Module IX.C. Raised Pavement Markings

- 1. American Traffic Safety Services Association (ATSSA), "ATSSA Quality Standards for Work Zone Traffic Control Devices," American Traffic Safety Services Association, Fredricksburg, VA.
- 2. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department

of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.

Module IX.D. Delineators

1. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.

Module X.A. Warning Lights

- 1. American Traffic Safety Services Association (ATSSA), "ATSSA Quality Standards for Work Zone Traffic Control Devices," American Traffic Safety Services Association, Fredricksburg, VA.
- 2. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.

Module X.B. Floodlights

1. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.

Module XI.A. G.R.E.A.T. Construction Zone (GCZ)

- 1. Energy Absorption Systems, 1992, "Certified Lifesaver Installation, Maintenance, and Removal (CLIMR) Training Program," Participant"s Workbook.
- 2. Woods, Donald L., Charles Pinnell, and Beverly A. Thompson, 1989 (August), "A Short Course on Inspection of Construction Zone Safety Hardware," Participant's Workbook.

Module XI.B. Sand-Filled Barrels

1. Woods, Donald L., Charles Pinnell, and Beverly A. Thompson, 1989 (August), "A Short Course on Inspection of Construction Zone Safety Hardware," Participant"s Workbook.

- Blume, Jayne, "Inspector"s Training Manual for Traffic Control Through Construction," Participant"s Notebook, Texas State Department of Highways and Public Transportation
- Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.
- 4. American Association of State Highway and Transportation Officials (AASHTO), 1988 (October), "Roadside Design Guide," AASHTO, Washington, DC.

Module XI.C. ADIEM (Advanced Dynamic Impact Extension Module)

 Syro Steel Company, ADIEM Product Information Brochure, SYRO Steel Company, Girard, OH.

Module XII.A. Portable Concrete Barrier

- 1. Woods, Donald L., Charles Pinnell, and Beverly A. Thompson, 1989 (August), "A Short Course on Inspection of Construction Zone Safety Hardware," Participant's Workbook.
- 2. Blume, Jayne, "Inspector"s Training Manual for Traffic Control Through Construction," Participant"s Notebook, Texas State Department of Highways and Public Transportation
- Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.
- 4. American Association of State Highway and Transportation Officials (AASHTO), 1988 (October), "Roadside Design Guide," AASHTO, Washington, DC.
- 5. Graham, J.L., J.R. Loumiet, and J. Migletz, 1987 (November), "Portable Concrete Barrier Connectors," "FWHA Report Number FHWA-TS-88-006," U.S. Department of Transportation, Federal Highway Administration, Washington, DC.

Module XII.B. Movable Concrete Barrier

 Woods, Donald L., Charles Pinnell, and Beverly A. Thompson, 1989 (August), "A Short Course on Inspection of Construction Zone Safety Hardware," Participant's Workbook.

- 2. Blume, Jayne, "Inspector"s Training Manual for Traffic Control Through Construction," Participant"s Notebook, Texas State Department of Highways and Public Transportation
- 3. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.
- 4. American Association of State Highway and Transportation Officials (AASHTO), 1988 (October), "Roadside Design Guide," AASHTO, Washington, DC.

Module XIII. Truck-Mounted Attenuator

- 1. Woods, Donald L., Charles Pinnell, and Beverly A. Thompson, 1989 (August), "A Short Course on Inspection of Construction Zone Safety Hardware," Participant's Workbook.
- 2. Blume, Jayne, "Inspector"s Training Manual for Traffic Control Through Construction," Participant"s Notebook, Texas State Department of Highways and Public Transportation
- 3. Federal Highway Administration, (1993, September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.
- 4. American Association of State Highway and Transportation Officials (AASHTO), 1988 (October), "Roadside Design Guide," AASHTO, Washington, DC.

Appendix B. Glossary

Activity Area - An area of roadway where any closure is in effect and the work takes place. It is composed of the work space and the traffic space, and may contain one or more buffer spaces. It is the portion of the traffic control zone that commences at the downstream end of the transition area and extends to the beginning of the termination area. (1).(4)

Advance Warning Area - The advance warning area starts at the beginning of the traffic control zone, where drivers are informed of what to expect. It extends to the transition area, or activity area if no transition area is utilized. In this area, the driver is given information about the hazards ahead and the actions needed to travel safely through the areas beyond. As soon as a channelizing device is encountered or a change in the normal travel path is imposed, the motorist has entered the next area. The advance warning may vary from a single sign or flashing lights on a vehicle to a series of signs in advance of the temporary traffic control zone transition area. (1),(4)

Agency - Governmental unit or organization.

Arrow Display (Panel) - An arrow display is a sign with a matrix of elements, capable of flashing or sequential displays, intended to provide additional warning and directional information. (1)

Average Daily Traffic (ADT) - The total volume during a given time period (in whole days), greater than one day and less than one year, divided by the number of days in that time period. (6)

Barricade - A portable or fixed device having from one to three rails with appropriate markings which provides a visual indicator of a hazardous location or the desired path a motorist should take. It is used to control traffic by closing, restricting, or delineating all or a portion of the right-of-way. It is not intended to contain or redirect an errant vehicle. (1).(2)

Barricade - Type I - Barricade with one horizontal element normally used on conventional roads or urban streets and arterials.⁽¹⁾

Barricade - Type II - Barricade with two horizontal elements, and more retroreflective area and intended for use on expressways and freeways or other high-speed roadways. (1)

Barricade - Type III - Barricade with three horizontal elements, often used at a road closure; may extend completely across a roadway or from curb to curb. (1)

Barrier - A device which provides a physical limitation through which a vehicle would not normally pass. It is intended to contain or redirect an errant vehicle.⁽²⁾

Bid - A written offer by a bidder to perform work at a quoted price. (5)

Bid Schedule - The prepared schedule included with the bid forms, containing the estimated quantities of pay items for which unit bid prices are invited.⁽⁵⁾

Bid Guarantee - A form of security assuring that the bidder will not withdraw a bid within the period specified for acceptance and will execute a written contract and furnish required bonds. (5)

Bid Bond - The security executed by the bidder and surety or sureties furnished to the Government to guarantee execution of the contract. (5)

Bid Forms - The agency or owner forms required for preparing and submitting a bid. (5)

Bidder - Any individual or legal entity submitting a bid. (5)

Breakaway - A design feature which allows a device such as a sign, luminaire, or traffic signal support to yield or separate upon impact. The release mechanism may be a slip plane, plastic hinges, fracture elements, or a combination of these. (2)

Bridge Railing - A longitudinal barrier whose primary function is to prevent an errant vehicle from going over the side of the bridge structure. (2)

Buffer Space - A buffer space is an optional feature in the activity area which provides a recovery space for errant vehicles and separates traffic flow from the work activity or a potential hazard. No work activity nor storage of equipment or material shall occur within this space. (1).(4)

Calendar Day - Each and every day shown on the calendar, beginning and ending at midnight. (4)

Centerline - A line indicating the division of the roadway between traffic moving in opposite directions.⁽³⁾

Change Order - A written order to the contractor covering changes in the plans or quantities, or both, within the scope of the contract, and establishing the basis of payment and time adjustments for the work affected by the changes. (3)

Channelizing Device - Channelizing devices are used to warn and alert drivers of hazards created by work activities in or near the traveled way, and to guide and direct drivers and pedestrians safely past the hazards. Channelizing devices include but are not limited to cones, vertical panels, drums and barricades. (1),(4)

Clear Zone - The total roadside border area, starting at the edge of the traveled way, available for safe use by errant vehicles. This area may consist of a shoulder, a recoverable slope, a non-recoverable slope, and/or a clear run-out area. The desired width is dependent upon the traffic volumes and speeds, and on the roadside geometry. (2)

Clear Run-out Area - The area at the toe of a non-recoverable slope available for safe use by an errant vehicle. (2)

Clearance - Lateral distance from edge of traveled way to a roadside object or feature. (2)

Closure - A closure is the taking of any portion of the roadway for the exclusive use of a work activity. (4)

Cone - Bright orange device used to channelize traffic and divide opposing traffic lanes, that doesn't damage vehicles on impact.⁽¹⁾

Contract - The written agreement between the agency or owner and Contractor setting forth the obligations of the parties for the performance of and payment for the prescribed work. (5)

Contract Time - The specified time allowed for completion of all contract work. (5)

Contract Modification - Any written change in the terms of the contract. (5)

Contracting Officer (CO) - An official of the agency or owner with the authority to enter into, administer, and/or terminate contracts and make related determinations and findings. The term includes certain authorized representatives of the CO acting within the limits of their authority as delegated by the CO.⁽⁵⁾

Contractor - The individual or legal entity contracting with the agency or owner for performance of prescribed work. (5)

Crash-worthy - A feature that has been proven acceptable for use under specified conditions either through crash testing or in-service performance. (2)

Crash Tests - Vehicular impact tests by which the structural and safety performance of roadside barriers and other highway appurtenances may be determined. Three evaluation criteria are considered, namely (1) structural adequacy, (2) impact severity, and (3) vehicular post impact trajectory.⁽²⁾

Crash Cushion - A traffic barrier used to safely shield fixed objects or other hazards from approximately head-on impacts by errant vehicles. Examples are sand-filled plastic barrels, water filled tubs, and vermiculite concrete cartridges.⁽³⁾

Crash Cushion (Impact Attenuator) - An impact attenuator device that prevents an errant vehicle from impacting fixed object hazards by gradually decelerating the vehicle to a safe stop or by redirecting the vehicle away from the hazard. (2)

Delineator - Device used in work areas to indicate the alignment of the roadway and to outline the required vehicle path through the temporary traffic control zone.⁽¹⁾

Design of Work Zones - The "design" of a traffic control zone for a highway work site involves determination of the geometry of the work zone features and the selection and location of all temporary traffic control devices. (4)

Detour - Road function that directs traffic onto another roadway to bypass the temporary traffic control zone. Detours should be signed clearly over the entire length so that motorists can easily determine how to return to the original roadway. A detour is initiated when traffic is directed to leave the normal roadway. (1),(4)

Detour Route - When a road is closed and a detour established, the traffic control zone includes the area where a detour route is begun. The detour route extends beyond the zone to divert traffic around the site and return it to the original route.⁽⁴⁾

Diminishing Zone Operations - A diminishing work zone is one where the entire traffic control zone is installed initially, and it is them reduced in size as the work progresses. Work is performed in the opposite direction of traffic flow, which enables the work space to be decreasing in length without moving the advance warning signs and taper. (4)

Diversion - Road function that directs traffic onto a temporary roadway or alignment placed in or next to the right-of-way, eg, median crossovers or lane shifts. (1)

Divided Highway - A highway with separated roadways for traffic in opposite directions. (3)

Double-Lane Closure - A double-lane closure is the closing of two adjacent lanes in the same direction on a multi-lane roadway. (4)

Downstream Taper - Downstream tapers are placed beyond (downstream from) a closure to indicate the traffic may return to the normal traffic lanes. Their use is optional, and the taper is permissive in that it does not require a change in travel path. This taper is useful in termination areas to provide a visual cue to the driver that access is available to the original lane/path that was closed. (1),(4)

Drum - Formidable, yet lightweight device used for traffic warning or channelization that doesn't damage impacting vehicles.⁽¹⁾

Duration of Work - Short-term Stationary - Daytime work that occupies a location from one to 12 hours. (1)

Duration of Work - Intermediate-term Stationary - Work that occupies a location from overnight to three days.⁽¹⁾

Duration of Work - Long-term Stationary - Work that occupies a location more than three days. (1)

Duration of Work - Mobile - Work that moves intermittently or continuously. (1)

Duration of Work - Short Duration - Work that occupies a location up to one hour.(1)

Edgeline - A line which indicates the edge of the travelway. (2)

Emergency Vehicle Storage Areas - When work occurs on a high-volume, highly congested facility in an urban area, it is the space used to store emergency vehicles to enable them to respond quickly to traffic incidents. The storage space is typically provided at the beginning or end of the activity area, or both.⁽¹⁾

End Treatment - The designed modification of a roadside or median barrier at the end. (2)

Expanding Zone Operations - For an expanding work zone, the initial installation consists of the advance warning signs, taper, and delineation of just enough of the activity area for work to begin. The work space is then increased in length as work progresses in the direction of traffic flow. The maximum zone length is determined by work accomplished. If cure time is required, the entire zone must remain in place while the last patch cures.⁽⁴⁾

Fast-Moving Operations - Fast-moving activities are those where the speed of the operation is in the range of 3 mph to 10-15 mph below the posted speed limit -- the higher differential being used with higher speeds.⁽⁴⁾

Flag - Device placed above signs to enhance their target value and increase motorists' awareness. Flags are useful for daytime operations only. Also a red 24-inch square cloth device with three-foot handle used as the secondary flagging device.⁽¹⁾

Flagger - A person whose primary function is to move vehicles and pedestrians safely and expeditiously through or around temporary traffic control zones while protecting on-site workers and equipment.⁽¹⁾

Flagger High Visibility Clothing - Clothing used by flaggers. For daytime work, the flagger's vest, shirt, or jacket, which shall be orange, yellow, strong yellow green or fluorescent versions of these colors. For nighttime work, similar outside garments shall be retroreflective. (1)

Flagger Station - Space where a flagger is positioned to control traffic. (1)

Flare - The variable offset distance of a barrier to move it further from the traveled way. (2)

Floodlight - Device used mainly at night to illuminate flagger stations, equipment crossings, and other areas where existing light is not adequate for the work to be performed safely. (1)

Freeway - An expressway with full control of access. (3)

Frontage Road/Street - A local street or road auxiliary located on the side of an arterial highway for service to abutting property and adjacent areas and for control of access. (3)

Fuse Plate - The plate which provides structural reinforcement to the sign post hinge to resist wind loads but which will release or fracture upon impact of a vehicle with the post. (2)

Glare Screen - A device used to shield a drivers eye from the headlights of an oncoming vehicle. (2)

Gore - The area immediately beyond the divergence of two roadways, bounded by the edges of those roadways. (3)

Grade - The rate of ascent or descent of a roadway, expressed as a percent; the change in roadway elevation per unit of horizontal length. (3)

Guardrails - Traffic barriers used to shield hazardous areas from errant vehicles. (3)

Hazard Identification Beacons (Flashing Electric Lights) - Flashing yellow light used at points of special interest to alert drivers' attention to these conditions. When used, the flashing beacon should operate 24 hours a day.⁽¹⁾

High Level Warning Device - A high-level warning device shall consist of a minimum of two flags with or without a Type B. high-intensity, flashing warning light. (1)

High Occupancy Vehicle (HOV) - A motor vehicle carrying a sufficient number of passengers to qualify for occupying a lane which is reserved for movement of a large number of people. (3)

Hinge - The weakened section of a sign post designed to allow the post to rotate upward when impacted by a vehicle. (2)

Impact Attenuator - Systems that mitigate the effects of errant vehicles that strike hazards, either by smoothly decelerating the vehicle to a stop when hit head-on or by redirecting the errant vehicle.⁽¹⁾

Impact Attenuator - Non-redirective Type - Roadside Device that may be struck head-on, and may be the sand-filled plastic barrel system or other acceptable energy-absorbing device designed to stop errant vehicles safely.⁽¹⁾

Impact Attenuator - Redirective Type - The redirective type is an assembled unit designed to absorb head-on vehicle impacts and telescope toward the rear; also it may be capable of absorbing side impacts by redirecting a vehicle.⁽¹⁾

Impact Attenuator - Roadside - Roadside attenuators are used in the same manner as permanent highway installation to protect motorists from the exposed ends of barriers, fixed objects, and other hazards.⁽¹⁾

Impact Attenuator - Truck-Mounted Attenuator (TMA) - Device on protective vehicles to protect workers or work equipment from errant vehicles. These protective vehicles are normally equipped with flashing arrows, changeable message signs, and/or flashers, and must be located properly in advance of the workers and/or equipment they are protecting. (1)

Impact Angle - For a longitudinal barrier, it is the angle between a tangent to the face of the barrier and tangent to the vehicle's path at impact. For a crash cushion, it is the angle between the axis of symmetry of the crash cushion and a tangent to the vehicle's path at impact.⁽²⁾

Influence Zone - The influence zone for a work operation is the portion of the highway network over which traffic is routed or diverted due to traffic restrictions at the work site and where traffic control procedures may be utilized to advise motorists of congestion and alternative routings. (4)

Inspector (Street Supervision) - A supervisor of public transportation line operations who evaluates performance, enforces safety and work rules, and untangles problems; an inspector may be mobile (covering several districts in a radio-equipped car) or fixed (assigned to a post at a designated intersection).⁽³⁾

Interim Markings - Pavement markings that may be used until it is practical and possible to install permanent markings that meet the full MUTCD standards for pavement markings.⁽¹⁾

Intermediate Term Activity - Intermediate-term activities are ones which require a few to several days to perform, thus nighttime closures are involved. (4)

Intermittent-Stop Operations - Intermittent-stop operations are highly mobile activities where a stop is required to perform the actual work. (4)

Lane Closure - A lane closure involves the closing of a traffic lane in such a manner that traffic is forced to move out of the closed lane and into another lane and the total number of lanes is reduced. (4)

Lane Narrowing - Lane narrowing is a reduction in lane width for those lanes carried through the activity area in order to maintain the maximum number of open lanes while accommodating the needs of the work activity.⁽⁴⁾

Lateral Buffer Space - A buffer space that may be used to separate the traffic space from the work space, or a potentially hazardous area, such as an excavation or pavement drop-off. (1)

Leap Frog Method Operations - This method of work zone operation is similar to the expanding work zone except that the advance warning area and transition may be set up in the protection of the closed lane, and then the upstream taper is removed. This technique further reduces the impact on road users. It requires a duplicate set of warning signs and devices used in the taper; however, the work space may be kept short, thus reducing the number of devices needed in the activity area. (4)

Length of Need - Total length of a longitudinal barrier needed to shield an area of concern. (2)

Long Term Activity - Long-term activities are those where the traffic control zone is in place for several days or longer. (4)

Longitudinal Barrier - A barrier whose primary function is to prevent penetration and to safely redirect an errant vehicle away from a road side or median hazard. (2)

Longitudinal Buffer Space - A buffer space that may be placed in the initial portion of a closed lane in advance of the work space. (1)

Median Barrier - A longitudinal barrier used to prevent an errant vehicle from crossing the highway median. (2)

Median - The portion of a divided highway separating the traveled ways for traffic in opposite directions. (2),(3)

Median Lane - A speed-change lane within the median to accommodate left-turning vehicles. (3)

Median Crossover - In the context of work zone closures, a median crossover is where one directional roadway is closed to traffic and that direction of travel is carried diagonally across the median onto the other directional roadway.⁽⁴⁾

Merging Taper - A merging taper is used to close a lane on a multi-lane highway and to direct traffic in the lane being closed to merge into the adjacent lane. A long taper of length L used to merge two adjacent lanes of traffic gradually and efficiently. (1).(4)

Moving Within a Zone Operations - For some operations, the activity area can best be lengthened or shortened as work progresses during the day. Either of these procedures lessens the impact upon road users as compared with closing the whole section for the entire work period. (4)

Non-standard Traffic Sign - A non-standard traffic sign is one which does not confirm to the design, application or placement criteria prescribed by the MUTCD -- and does not meet the requirements for a special sign defined below.⁽⁴⁾

Non-Recoverable Slope - A slope which is considered traversable but on which the errant vehicle will continue on to the bottom. Embankment slopes between 4:1 and 3:1 may be considered traversable but non-recoverable if they are smooth and free of fixed object hazards.⁽²⁾

Notice to Proceed - Written notice to the Contractor to begin the contract work. (5)

Off-Site Detour - An off-site detour is where traffic is diverted onto another highway in order to bypass the work site.

Offset - The distance between the traveled way and a roadside barrier or other obstacle. (2)

On-Site Detour - An on-site detour is where traffic is diverted within the same roadway in order to bypass the work site. (4)

One-Lane, Two-Way Traffic Control - Where traffic in both directions must, for a limited distance, use a single lane, and provisions should be made for alternate one-way movement through the constricted section.⁽¹⁾

One-Way Traffic Control - Flag Transfer Method - The flag transfer method should be employed only when the one-way traffic is confined to a relatively short length of road, usually not more than 1 mile in length. (1)

One-Way Traffic Control - Flagger Method - Where a one-lane two-way temporary traffic control zone is short enough to allow visibility from one end to the other, thus allowing traffic to be controlled by either a single flagger or by a flagger at each end of the section. (1)

One-Way Traffic Control - Pilot Method - Method where a pilot car is used to guide a queue of vehicles through a normally complex temporary traffic control zone or detour. Its operations must be coordinated with flagging operations or other controls at each end of the one-lane section. (1)

One-Way Traffic Control - Temporary Traffic Signal Method - Method where traffic signals are used to control vehicular traffic movements in temporary traffic control zones. (1)

One-Way Traffic Control - Stop or Yield Method - Method where a yield or stop sign may be installed on low-volume, two-lane roads where one side of the roadway is closed and the other side must serve both directions. The side that is closed should yield to or stop for oncoming traffic on the side that is open.⁽¹⁾

Operational Barrier - One that has performed satisfactorily in full-scale crash tests and has demonstrated satisfactory in-service performance. (2)

Pavement Markings - Markings set into the surface of, applied upon, or attached to the pavement for the purpose of regulating, warning, or guiding traffic. Pavement markings convey their message without diverting the driver's attention from the driving task. (1.3)

Pay Item - A specific item of work for which a unit and price is provided in the contract. (5)

Payment Bond - The security executed by the Contractor and surety or sureties furnished to the agency or owner to assure payments as required by law to all persons supplying labor or material according to the contract.⁽⁵⁾

Pedestrian Path -A footway or track reserved for use by pedestrians or joggers. (3)

Performance Standard - A formally established criterion for special activity which (a) outlines the work involved; (b) describes work methods and composition of efficient crews; and (c) lists the expected accomplishments or productivity rate. (3)

Performance Bond - The security executed by the Contractor and surety or sureties and furnished to the agency or owner to guarantee completion of the contract work. (5)

Plans - The contract plans furnished by the agency or owner showing the location, type, dimensions, and details of the work. (5)

Portable Barrier - Barrier designed to prevent vehicles from penetrating the space behind the barrier while minimizing occupant injuries. Portable barriers are also used to channelize traffic.⁽¹⁾

Portable Changeable Message Sign - Traffic control devices with the flexibility to display a variety of messages to fit the needs of road and street authorities. (1)

Project - The specific section of the highway or other property, together with all appurtenances, on which construction is to be performed under the contract. (3),(5)

Proposal - The offer of a bidder to perform stated construction work at the prices quoted. (3)

Quality Standard - A formally established criterion for a specific activity which (a) describes a deficiency, condition, or schedule that established the need for work; (b) outlines the work involved; (c) tells how to achieve good workmanship, possibly including the number and type of work units which are usually required to meet the quality standards; and (d) lists expected end results. (3)

Raised Pavement Markers (RPMs) - Markers considered for use along surfaced detour or temporary roadways, and other changed or new travel lane alignments, because of the need to accentuate changed travel paths and their wet-weather performance capabilities. They may have retroreflective elements or not.⁽¹⁾

Recoverable Slope - A slope on which a motorist may, to a greater or lesser extent, retain or regain control of a vehicle. Slopes flatter than 4:1 are generally considered recoverable. (2)

Recovery Area - Generally synonymous with clear zone. (2)

Resurfacing - The placing of one or more new courses on an existing surface. (3)

Right-of-Way - A general term denoting land, real property, interest therein, usually in a strip, acquired for or devoted to transportation purposes. (3),(5)

Roadside - That area between the outside shoulder edge and the right-of-way limits. (2)

Roadside Barrier - A longitudinal barrier used to shield roadside obstacles or non-traversable terrain features. It may occasionally be used to protect pedestrians or "bystanders" from vehicle traffic. (2)

Roadside Signs - Roadside signs can be divided into three main categories: overhead signs, large roadside signs, and small roadside signs. Large roadside signs may be defined as those 50 square feet or greater in area. Small roadside signs may be defined as those less than 50 square feet in area.⁽²⁾

Roadway - The portion of a highway, including shoulders, for vehicular use. A divided highway has two or more roadways. In construction specifications, the roadway is the portion of a highway within limits of construction. (2),(3),(4),(5)

Roadside - A general term denoting the area, within the right-of-way, excluding the traveled way and shoulders, adjoining the outer edge of the roadway. Extensive areas between the roadways of a divided highway may also by considered roadside.⁽³⁾

Rumble Strip - Transverse strips of rough-textured surface used to supplement standard or conventional traffic control devices. It provides a vibratory and audible warning that alerts drivers to unusual traffic conditions.⁽¹⁾

Safety Rest Area - A roadside area with parking facilities separated from the roadway provided for motorists to stop and rest for short periods. It may include drinking water, toilets, tables and benches, telephones, information, and other facilities for travelers. (3)

Screen - Device used to block the driver's view of activities that can distract from the driving task. Screening also contains the work area and keeps dust and debris off the pavement. Screens are primarily useful on long-term temporary traffic control.⁽¹⁾

Shielding -The introduction of a barrier or crash cushion, between the vehicle and an obstacle or area of concern to reduce the severity of impacts of errant vehicles.⁽²⁾

Shifting Taper - A shifting taper is used to move traffic into a different travel path, via a lateral shift, but where merging is not required. (4)

Short Term Activity - Short-term activities are those that are accomplished during one daylight period. (4)

Shoulder - The portion of the roadway contiguous with the traveled way primarily for accommodation of stopped vehicles for emergency use, and for lateral support of base and surface courses. (3),(4),(5)

Shoulder Taper - Shoulder Tapers are used on high speed roadways to close improved shoulders that may be mistaken for driving lanes. If used, shoulder tapers approaching the activity area should have a length of one-third of a merging taper. (1).(4)

Shy Distance - The distance from the edge of the traveled way beyond which a roadside object will not be perceived as an immediate hazard by the typical driver, to the extent that he will change his vehicle's placement or speed.⁽²⁾

Sidewalk - That portion of the roadway primarily constructed for the use of pedestrians. (3)

Sight Distance - The length of highway visible to the driver. (3)

Sign - Device that conveys both general and specific messages by means of words or symbols and have the same three categories as all traffic signs: namely, regulatory signs, warning signs, and guide signs.⁽¹⁾

Slope - The relative steepness of the terrain expressed as a ratio or percentage. Slopes may be categorized as positive (backslopes) or negative (foreslopes), and as parallel or cross slopes in relation to the direction of traffic.⁽²⁾

Solicitation - The complete assembly of related documents (whether attached or incorporated by reference) furnished to prospective bidders.⁽⁵⁾

Special Provisions - Additions and revisions to the standard and supplemental specifications applicable to an individual project. (3),(5)

Special Traffic Sign - A special traffic sign is one that meets a need not covered by a standard sign and which has been approved for use by competent authority. (4)

Specifications - The compilation of written provisions and requirements for the performance of prescribed work. (3),(5)

Speed-Change Lane - An auxiliary lane, including tapered areas, primarily for the acceleration or deceleration of vehicles entering or leaving the through traveled way. (3)

Standard Plans - Detailed plans approved for repetitive use and included as part of the plans. (5)

Standard Specifications - The Standard Specifications for Construction of Roads and Bridges of Highway Projects approved for general application and repetitive use. (5)

Standard Traffic Sign - A standard traffic sign is one that is defined in the Manual on Uniform Traffic Control Devices (MUTCD), is used for the purpose for which it is intended, and is placed in the prescribed location. (4)

Steady-Burning Electric Lamps - A series of low-wattage yellow electric lamps. They may be used to mark obstructions, but they are generally less effective than flashing lights for such use because of their attention-getting effect.⁽¹⁾

Stop/Slow Paddle - Octagonally-shaped sign that has STOP on one side and SLOW on the other side which is used by flaggers and gives drivers more positive guidance than red flags and should be the primary hand-signaling device. (1)

Subcontractor - An individual or legal entity with whom the Contractor sublets part of the work. This includes all subcontractors in any tier. (5)

Superintendent - The Contractor's authorized representative in responsible charge of the work. (5)

Supplemental Plate - A supplemental plate is placed below a sign to provide additional information related to that sign. (4)

Taper - A series of channelizing devices or pavement markings placed to move traffic out of or into its normal path and used in both transition and termination areas.⁽¹⁾

Temporary Barrier - Temporary barriers are used to prevent vehicular access into construction or maintenance work zones and to redirect an impacting vehicle so as to minimize damage to the vehicle and injury to the occupants, while providing worker protection. (2)

Temporary Raised Island - Islands not to exceed four inches in height used to supplement channelizing devices and pavement markings to separate traffic flows in two lane, two-way operations.⁽¹⁾

Temporary Traffic Control Zone - A traffic zone that includes the entire section of roadway between the first advance warning sign through the last traffic control devices, where traffic returns to its normal path and conditions.⁽¹⁾

Temporary Traffic Signal - Signal used for special applications to control traffic flow at temporary traffic control zones.⁽¹⁾

Termination Area - The termination area is used at work sites to allow traffic to clear the activity area and return to the normal traffic operations. It is the final portion of the traffic control zone that commences at the downstream end of the activity area and extends from the downstream end of the work space to the END ROAD WORK signs, if posted. (1),(4)

Traffic Barrier - For work zone traffic control, a barrier is a device designed to prevent vehicular penetration into areas behind the barrier. It is often used to prevent a vehicle from striking a more severe obstacle or feature located on the roadside or in the median, or to prevent crossover median accidents. As defined herein, there are four classes of traffic barriers, namely, roadside barriers, median barriers, bridge railings, and crash cushions. (2)(4)

Traffic Control - Traffic control is the process of regulating, warning and guiding road users and advising to traverse a section of highway or street in the proper manner. (4)

Traffic Control Device - Traffic control devices are signs, signals, markings or other devices placed on or adjacent to a street or highway by authority of a public body or official having jurisdiction to regulate, warn or guide road users. At work sites, other traffic control devices are commonly employed, such as channelizing and delineating devices. (1).(3).(4)

Traffic Control Plan (TCP) - A plan, or set of plans, that describes traffic controls to be used for facilitating vehicle and pedestrian traffic through a specific temporary traffic control zone or project. (1),(4)

Traffic Control Zone - A traffic control zone for temporary traffic control at a work site is the entire section of the roadway over which control related to the work operation is exercised and in which any temporary traffic control devices are placed.⁽⁴⁾

Traffic Shifting - Traffic shifting is the lateral displacement of one or more travel lanes from their normal travel path in order to accommodate a work space in the roadway. All lanes are carried through, and no merging operation is involved. (4)

Traffic Space - The portion of the roadway in which traffic is routed through the activity area. (1)

Traffic Splitting - Traffic splitting is the situation encountered on a multi-lane roadway where open travel lanes are carried around both sides of a work space. (4)

Transition - A section of barrier between two different barriers or, more commonly, where a roadside barrier is connected to bridge railing or to a rigid object such as a bridge pier. The transition should produce a gradual stiffening of the approach rail so vehicular pocketing, snagging, or penetration at the connection can be avoided.⁽²⁾

Transition Area - A transition area is a traffic control zone where some form of closure occurs and traffic must therefore be channelized from the normal path to a new path, usually involving strategic use of tapers. In this area, traffic is channelized from the normal highway lanes to the paths required to move through the activity area. It is the portion of the traffic control zone that commences at the downstream end of the advance warning area and extends to the beginning of the activity area. (1),(4)

Traveled Way - The portion of the roadway designated for the ordinary movement of vehicles, exclusive of shoulders and auxiliary lanes; it extends from edge line to edge line. (2),(3),(4),(5)

Traversable Slope - A slope from which a motorist will be unlikely to steer back to the roadway but may be able to slow and stop safely. Slopes between 4:1 and 3:1 generally fall into this category.⁽²⁾

Tubular Marker - Channelizing device, predominantly orange, not less than 18 inches high, minimum 2 inches wide when facing traffic, and made of a material that can be struck without damaging impacting vehicles.⁽¹⁾

Two-lane, Two-way Operation (TLTWO) - Two-lane, two-way operation (TLTWO) is where one directional roadway is closed on a four-lane divided highway and both directions of travel utilize the remaining roadway with one lane in each direction. (4)

Two-Way Traffic Taper - The two-way traffic taper is used in advance of an activity area that occupies part of a two-way roadway in such a way that a portion of the road is used alternately by traffic in each direction. This normally means closure of one lane of a two-lane, two-way highway. The remaining lane is used alternately by traffic in each direction, typically under the control of flaggers, police officers, or temporary traffic signals. (1).(4)

Upstream Tapers - Upstream tapers are placed in advance of the space that is being protected. They are directive in that they force traffic in the affected lane to follow a new travel path. The four taper types that follow are all upstream tapers. Merging taper: L minimum, Shifting taper: 1/2 L minimum, Shoulder taper: 1/3 L minimum, Two-way traffic taper: 100 feet maximum. (1),(4)

Vertical Panel - Channelizing device used to channel traffic, divide opposing lanes of traffic, divide traffic lanes, or in place of barricades where space is limited. They shall be 8 to 12 inches wide and at least 24 inches high.⁽¹⁾

Warning Light - A portable, lens-directed, enclosed light. The color of the light emitted shall be yellow. It may be used in either a steady-burn or flashing mode. They are effective in attracting a driver's attention and are useful supplements to the retroreflectorization on channelizing device. (1)

Warning Light - Type A Low Intensity Flashing - Yellow light most commonly mounted on barricades, drums, vertical panels, or advance warning signs, intended to warn drivers that they are approaching or in a hazardous area.⁽¹⁾

Warning Light - Type B High Intensity Flashing - Yellow light normally mounted on advance warning signs or on independent supports. (1)

Warning Light - Type C Steady Burn - Yellow light intended to delineate the edge of the traveled way on detour curves, on lane changes, on lane closures, and on other similar conditions. (1)

Warrants - The criteria by which the need for a safety treatment or improvement can be determined. (2)

Weaving Section - A length of one-way roadway at one end of which two one-way roadways merge and at the other end of which they separate. (3)

Work Order - A written order, signed by the engineer, of a contractual status requiring performance by the contractor without negotiation of any sort. (3)

Work Space - The portion of the roadway closed to traffic and set aside for workers, equipment, and material. (1)

REFERENCES

- 1. Federal Highway Administration, 1993, (September 3), Part VI of the "Manual on Uniform Traffic Control Devices," "Standards and Guides for Traffic Controls for Street and Highway Construction, Maintenance, Utility, and Incident Management Operations," U.S. Department of Transportation, Federal Highway Administration, 1988 Edition, Revision 3, Washington, DC.
- 2. American Association of State Highway and Transportation Officials (AASHTO), 1988 (October), "Roadside Design Guide," AASHTO, Washington, DC.
- 3. American Association of State Highway and Transportation Officials (AASHTO), 1983, "Transportation Glossary," AASHTO, Washington, DC.
- 4. Lewis, R.L., "Work Zone Traffic Control Concepts and Terminology," Transportation Research Record 1230, Transportation Research Board Division of the National Research Council, Washington, DC.
- 5. Federal Highway Administration, 1992, <u>FP-92</u>, "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects," United States Government Printing Office, Washington, DC.
- 6. American Association of State Highway and Transportation Officials (AASHTO), 1990, "A Policy on Geometric Design of Highways and Streets," AASHTO, Washington, DC.



WORK ZONE SAFETY INSPECTION TRAINING COURSE

SUPPLEMENT

January 1997

Supplement to the Work Zone Safety Inspection Training Course

SECTION I: Instructions to the Trainer

Introduction:

The Federal Highway Administration, Office of Highway Safety, in cooperation with the National Highway Institute (NHI) and the Local Technical Assistance Program (LTAP) Directors has developed a Trainer's Packet to be used with the corresponding "Work Zone Safety Inspection Training Course," NHI Course Number 38063. These materials were developed to train construction work zone (wz) inspectors through training courses delivered by WZ Safety Trainers.

Three sections are included in the Trainer's Packet to assist the trainer. The sections contain supplemental information and suggestions for using the training packet, coordinating with the LTAP Course Coordinators, "customizing the course," and presenting the course.

The NHI has declared the Course No. 38063 (Instructor's Guide and Participant's Manual) in the "public domain," and available for unrestricted public use. The Participant's Manual should be copied for distribution to the students. The Instructor's Guide is furnished with the suggested revisions to the course, and diskettes are furnished for the trainer's convenience to add State and/or local standards and specifications as appropriate.

Disclaimer:

The materials contained in the Trainer's Packet are suggested training aids. There is intended no implied endorsement of any products or equipment discussed, displayed, or introduced in the Trainer's Packet. The trainer may display and discuss other products or equipment and/or those found in the Trainer's Packet with written consent and approval from the manufacturer(s), and State or local agencies that would otherwise allow such materials or products in their construction plans and specifications. The materials in the Trainer's Packet are furnished by the manufacturer with permission from their licensed distributors for display and discussion as training aids.

Overview:

Take inventory. The Trainer's Packet consists of one carrying case and one medium-sized box. There is one inventory list in each container (Appendix I). Taking inventory allows you, the trainer, the opportunity to get familiar with the packet. As a reminder, please leave an updated inventory list in each container. The following are suggested steps for the trainer in the inventory process:

- Make copies of the inventory list (to use as check lists).
- Check each item on the check list.
- Develop your own inventory but return the core Trainer's Packet (as received by the trainer with updated inventory list) to the coordinator. The LTAP Course Coordinator may then reorder any items consumed or shortages resulting from the training.
- Check for recent changes made to the course. Inventory lists and check list changes may be required. The LTAP Course Coordinator will coordinate suggested changes to the packet and changes affecting the course materials from changes to the MUTCD.
- Please review each item, especially the view graphs, photographs, and slides to check for quality flaws. Please report poor quality items or shortages to the LTAP Training Coordinator.
- Before requesting replacements of visual aids (slides and view graphs), consider replacing slides and/or photographs with those taken at a work zone in your vicinity in a scenario similar to that depicted in the poor slide or photograph.
- The training coordinator will determine the disposition of the packet. It is assumed that the packet will be returned as requested by the coordinator (with or without changes).
- Add to the inventory list and secure in the packet the American Association of State Highway and Transportation Officials (AASHTO) Computer Assisted Transportation Training (CATT). Request assistance from the training coordinator, if needed.

Organize the Course:

After taking inventory, determine who will receive the training. The trainer is encouraged to "customize" the course for his/her presentation. The core course, NHI Course 38063, may be copied in part or totally to fit the audience's needs. This copy may remain with the trainer for reuse. The training coordinator should establish the policy for the disposition of the packet. The trainer should consider his/her style of presentation. State and/or local plans and specifications, and maintenance operations and utility work to determine if any or all of the packet materials are to be presented and displayed.

The Training Coordinator may have received a request for training. In this case, the trainer may call the requesting agency's Point of Contact (POC) to determine when training is required and who is to be trained (State or local, project inspectors and/or maintenance/utility, and/or operation/inspection personnel). In most cases, a mix of inspectors should be expected, but if

one specific group dominates the class, emphasis should be placed on that group with the workshops.

In another case, the trainer may be assigned to train WZ inspectors and probably already knows the POC and who is to receive training. In either case, the trainer should make a course assessment. If a large group (more than 12) is to be trained, for the recommended two-day course, two instructors should present the course. For a small group (12 and fewer), one trainer may present the two-day, or shorter duration, course.

The one-day course is discouraged, but one trainer may make the abbreviated presentation. The one-day course is entirely described in the Work Zone Safety Inspection, Instructor's Guide and may still be available through the NHI. This option should be considered by the requesting agency. Also, individual training (e.g., CATT), as well as other training, is available from the LTAP Centers. The trainer should appraise the POC or the requesting agency and together decide where the course training fits within the agency's training objective and the course agenda.

Develop the Agenda. The "Course Preparation Instructions," NHI Course No. 38063, Instructor's Guide, coupled with the Trainer's experience, may be used to adequately plan a one-day course. Since the one-day course is not within the scope of this section, the trainer should allow a 15- to 20-minute training session for "Inspector Ethics Training." This session is discussed further in Section II, "A Guide to Preparing Your Course." The trainer, course coordinator, and training program administrator may change these instructions as appropriate per the user agency's training policy to emphasize the one-day course. The intent of the Sections I through III is to assist the trainer in developing a two-day course.

The two-day "Work Zone Safety Inspection Training Course" is discussed further in this section. The modules, as presented in the Instructor's Guide, are referenced below. Please refer to the Instructor's Guide and make the following changes (see Appendix II: Changes):

- 1. Delete Table of Contents sheets iv and v and replace with new sheets iv and v, making other changes to reflect changes in the course.
- 2. Delete sheets IG-3 and IG-4 and replace with new sheets IG-3 and IG-4.
- 3. Delete IG-13 and IG-14 and add new sheets IG-13 and IG-14.
- 4. Add *Professional Ethics Section*, new sheets IG-30a through IG-30n.
- 5. Delete sheets IG-37 and IG-38, and add the substitute sheets IG-37 and IG-38.
- 6. Delete sheets IG-40 and IG-41, and add the substitute sheets IG-40 and IG-41.

- 7. Delete sheets IG-65, IG-66, and IG-67, and add the new sheets IG-65, IG-66, and IG-67.
- 8. Delete sheets IG-76 through IG-80, and add the substitute sheets IG-76 through IG-80.
- 9. Substitute sheet IG-84.
- 10. Add new INSPECTION CHECKLIST--Flagger/Devices, sheet IG-89.
- 11. Delete Sheets IG-276, IG-277, IG-288, and IG-279, and add new substitute sheets IG-276, IG-277, IG-278, and IG-279.

Supplement to the Work Zone Safety Inspection Training Course

SECTION II: A Workbook for Preparing Your Course

Introduction:

After becoming thoroughly familiar with Section I: Instructions to the Trainer, the trainer is encouraged to use this guide (Section II) and Section III: Recommended Workshops to develop a local course meaningful to the Construction Work Zone Inspector. The course materials (NHI Course No. 38063) and the materials in the packet may be "customized" to any desired degree to emphasize "real-time" local procedures, policies, and standards. Supervisors (Project, Resident, District Engineers, Project Managers or their representatives) should be consulted to determine the training emphasis.

Additionally, the Local Technical Assistant Program (LTAP) training coordinator or program administrator should be consulted to ensure all materials provided herein are current. Consideration should be given to other pertinent work zone safety materials and training courses available commercially. The administrator may have a time schedule, so it may be necessary to coordinate the return of the Trainer's Packet. Arrangements may be made with the LTAP program administrator and the trainer's agency to copy the *Participants Manuals* or obtain additional materials in the Trainer's Packet.

This Trainer's Packet complements and supplements the Instructor's Guide furnished with the course materials to develop a two-day course. The distinction, for the trainer, is that the Instructor's Guide, with an added section in "Professional Ethics," is recommended for use as a one-day course. The Instructor's Guide is considered the **core** of course development. Only those sections in that guide that will significantly change will be further discussed and referenced in Sections II and III.

Professional Ethics:

The trainer should refer to his or her agency's Standard Operating Procedures and policy statements to summarize the importance of professional ethics. It is recommended that a Code of Ethics from a professional engineering society be used. The code of ethics used in this training course was copied with permission from the American Society of Civil Engineers (ASCE). The agency's project engineer, project manager, district engineer, or guest speaker may agree to present the ethics section.

The "Standards of Ethical Conduct for Employees of the Executive Branch," United States Office of Government Ethics, is given as a reference and may be used in the presentation of this

Professional Ethics section. The view graph of the cover, "Standards of Ethical Conduct for Employees of the Executive Branch," Sections 2635.101 through 2635.204, is included in the Trainer's Packet (one reproduceable copy and diskette in WordPerfect 6.1 format). They are included for the trainer's use in developing the instructional materials and handout examples. The "Introduction to Ethics" section, which was presented during the pilot course in Sterling, Virginia, is also included. The pilot course was attended by Federal inspectors from the Eastern Federal Lands Division office.

The trainer is encouraged to research his or her agency's ethics literature, requirements, and policies as they apply to construction and work zone inspectors. It is recommended that only factual examples (both positive and negative) of ethical conduct be used in your presentation. Once the Professional Ethics section has been presented, it may be inserted into the Instructor's Guide, as suggested in Section I.

References:	
Trainer's Packet:	"Introduction to Ethics," presented to Federal Highway Administration's pilot course in Sterling, Virginia.
	View graph of cover, "Standards of Ethical Conduct for Employees of the Executive Branch," United States Office of Government Ethics, (Possible handout of Sections 2635.101 through 2635.204), and ASCE's Code of Ethics.
State and local:	Policy Statements, other references:

Contract Documents

Section II of the Instructor's Guide, Inspection Basics is sufficiently detailed for the two-day training course. It is recommended that contract documents from a current local project be discussed during the training course. These documents will be linked to Work Shop 1 (Section III). Each student should bring to class: a) a copy of the State specifications (assuming that county and local jurisdictions use the same specifications), and b) a copy of Part VI of the Manual on Uniform Traffic Control Devices (MUTCD), 1988 Edition of MUTCD, Revision 3, September 3, 1993 (may be provided by trainer, if requested by agency). The trainer should also

have a copy the 1988 Edition of the MUTCD. Other references and documents (listed below) should be requested and secured from the supporting agency or jurisdiction.

Trainers should have available the following training materials from an active highway agency construction project:

- Sufficient copies of the Traffic Control Plan (TCP) for each of the class participants.
- At least one copy of the Contract Special Provisions for each Work Shop 1 Group.
- At least one copy of the change order for each Work Shop 1 Group (current or completed work on the same project).
- One copy of the Standard Plans.
- One copy each: Documentation Record, Order Record, Certificate of Acceptance.
- Sufficient copies of any inspection document that the trainer deems appropriate for training emphasis.

The trainer should have a working knowledge of each section of the Standard Specifications and Special Provisions that are applicable to work zone traffic control and safety. The Instructor's Guide recommends presentation techniques.

- 1. Highlight or index each section of the Standard Specifications and Special Provisions that applies to WZ Inspection. Briefly describe each section of the documents (i.e., Scope of the Work, Section 1__, of the Standard Specifications, including the Intent of Contract, Disputes, Value Engineering, and Contractor Records). Discuss how the contractor may be required to keep receipts of certain WZ items and describe why the documents are necessary for payment and proof of acceptance on the project.
- 2. Discuss the agency's contract provisions under the qualified products list of the specifications. Introduce the National Transportation Product Evaluation Program (NTPEP) of the American Association of State Highway and Transportation Officials (AASHTO) and how the program ties into the agency's qualified products list. The trainer should contact the materials engineer and/or others for additional information about specific State and local programs. Guest speakers may be invited.
- 3. Also, if applicable to the agency's plans and specifications, discuss *Enforcement* items, specifically, what authority the police have.
- 4. Compare the agency's state flagger and construction supervisor certification requirements, if any, with other States (Figures 1- 4 summaries). Prepare a brief class

discussion (five minutes) of advantages or disadvantages of such a program. If the agency's State does not have certification requirements, comparison and discussion may be useful for class discussion.

References:	
Packet:	A Guide to NTPEP, AASHTO's National Transportation Product Evaluation Program. Copy handout as needed.
	"Flagger and Supervisor Certification Programs Summary, Figures 1 through 4." Copy summaries and handout.
State and Local:	Bring: Specifications and Part VI of MUTCD, 1988 Edition of MUTCD, Revision 3, September 3, 1993 (Note: Each student should also bring to this class). Sections to discuss:
	Special Provisions, six Sets: (One per group: project no., project description, etc.).
	Local Traffic Control Plan (TCP) (One per student, allow sufficient time for local project engineer's office or others from the agency to develop the copies).
	Change Order, six copies: (One per group: use in conjunction with the TCP onlyif the TCP has not be amended, do not discuss plan changes in work shops). Standard Plans, One Each/Class: (Reference available with workshop).
	Documentation Record, One Each. Order Record, One Each. Certificate of Acceptance, One Each. Other Documents as requested by Training Administrator.

Present Workshop No. 1

Section III, Workshops, suggests additional details for developing the video and the handout for this workshop. Workshop No.1 should be designed and developed to stimulate the class and enhance student interaction. The trainer should make mental assessments of each individual inspector's participation. If the need for further individual training is detected, the training modules and summary following the workshop may emphasize those areas, and/or the agenda may be modified by substituting modules, or the trainer may recommend interactive training (e.g., Traffic Control in Construction Work Areas, AASHTO Computer Assisted Transportation Training) available through the LTAP Training Administrator.

The workshop should also be designed to use "teamwork," or group synergy. Students should, as a team, present an account of the group's approach and agree on the resolution to their assigned workshop problem(s), sharing with each other the information requested from the TCP (handout, Instructor's Guide, page IG-59, H2C-1). This may be accomplished by assigning each individual a task, as outlined in the handout. Introduce the TCP and the project documents to the class (each student should have a copy of the TCP):

- Give the class no more than five minutes (using the TCP) to answer the questions on the handout. Assure them that they will have time to answer the questions in their group.
- Assign each student to a group; four groups are desirable per class. Recommended procedure: Students "count off," or have numbered chairs and randomly assign numbers to different groups. Avoid the buddy system.
- From the preselected problem sets (see Section III, First Workshop) give each group at least two problems. Handout Instructions for Workshop I to each student.
- Read the workshop instructions (H2C-2) and answer any questions before proceeding.
- Discuss the process (Section III, First Workshop) for getting the video footage for the workshop (e.g., procedure required to request permission to film video of local project). Describe the project before viewing the video.
- View the video of the local project.
- Give the groups sufficient time to subdivide, discuss, analyze, and prepare a solution to the assigned group problems.
- Call time and have each group present the problem's solutions to the class. The view graph (transparency) of the problem photograph should be viewed while the problem solution is given.

- Discuss each problem's solution.
- Ask for volunteers to present to the class one answer to each of the questions on H2C-1.
- Summarize.

Refer	rences:	
	Packet: Inst	ructor's Guide, Handouts (H2C-1 & 2).
		View graphs (transparencies).
		Section III.
	* .	ATSSA: "Quality Standards for Work Zone Traffic Control
		Devices (1993)".
		3M: "Project Inspector's Guide for the Construction Work Zone."
	State and Local:	Video of local work zone.
		Specifications and Part VI of MUTCD, 1988 Edition of MUTCD, Revision 3, September 3, 1993.
		Local TCP (one per student).
		Special Provisions, four Sets: (One per group: project no., project description, etc.).
		Change Order, Six Copies: (One per group: use in conjunction with Traffic Control Plan Only.
+1.1 -		Standard Plans, One Each/Class: (Reference available for class).
		Documentation Record, One Each.
		Order Record, One Each.
		Certificate of Acceptance, One Each.
		Other Documents as requested by Training Administrator.

Present Traffic Control and Work Zone Devices Modules

Lesson plans may be developed for each traffic control and work zone device module for which training is requested, or the module in the core course materials may be used as presented in the Instructor's Guide. The Standard Plans and Special Provisions and contract documents for the local work zone project must be researched to present the approved State or local standards.

Proprietary Items: Guidance about presenting training on proprietary items must follow State and/or local policy. Policy guidance should be consulted and strictly followed to avoid any perception of bias for any one product or manufacturer. Where training on proprietary items is necessary, a guest speaker(s) is strongly advised to avoid any misrepresentation of proprietary products.

Commercial Literature: The commercial materials presented in the packet are for display and handout only. They should be considered training aids and not for instructional purposes. For training purposes of this course, all of the commercial literature may be substituted with local literature or brochures. The displays and training aids should exhibit an unbiased display of one product with at least two sources and/or manufacturers.

The materials provided in the packet may be replaced or replenished before each class. Commercial participants should be contacted early (6-8 weeks) for additional materials. There may be a small fee for ordering additional materials. The consent letters, included with the inventory record of the packet, describe a procedure or desired point of contact (POC) by the commercial participants included in the packet.

The trainer is not limited to the resources provided in the training packet. Other training modules may be developed and included in the course. For instance, the trainer may be mandated or surmise from the initial inquiries with the State or local agency or from the contract documents of the work shop work zone (see Presentation of Work Shop I, below) that the class needs training in portable signal systems. The trainer may then research the LTAP literature, and consult the Training Administrator, State and local specifications, and commercial resources to develop a presentation for the class in portable signal systems.

The module, Portable Signal Systems, as developed, then is ready to be presented to the class, added to the Instructor's Guide, and through the LTAP Administrator, shared with all the other LTAPs and the Office of Highway Safety.

ket: Inventory Lists. Letters of Consent. AASHTO: "Publications Catalog," One per student. ATSSA: "Education and Training Catalog," One per student. ATSSA: "Flagging Handbook," One per student. Kentucky Department of Highways/Kentucky Transportation Center: "Flagging Tips Brochure," One per student. SHRP Implementation: "Innovative Devices for Safer Work Zones," One per student.
ocal: (Developed trainers' sources and LTAP Administrator's Materials).

Present Workshop No. 2

Workshop No. 2 should be designed to sharpen the inspectors' skills in the identification of the manufacturer and specifications of sign and retroreflective materials and other materials specifications (AASHTO, ASTM, State and/or local). Materials specifications provide the inspector the means to control quality. Accurate interpretation of the specifications is stressed, and the difference between deficiencies and discrepancies will be understood in the use of the signs and cones.

It is strongly suggested the trainer use all of the training aids provided to improve or exercise the inspector's skills used routinely in work zones. The workshop may easily be expanded with additional training resources to aid the student in the identification of traffic control devices and their placement, and uses in short-term zones (maintenance work zones).

For maintenance operations, the trainer should refer to State or local resources. The Louisiana Department of Transportation and Development, "Maintenance Traffic Control Handbook," may be reproduced (all or parts) and used to develop the work shop. The use of other resources is

encouraged. Examples: Using three groups,

- First group, layout the proportional transition to an assigned maintenance area on a two lame roadway. Provide copies of maintenance handhook (LDOTD or other). Discuss the procedure, before the class.
- Second group, fabricate proportional sign posts and sign frames (trainer provides supplemental materials, in addition to miniature signs provided in packet). The signs provided are 8-inch x 8-inch signs. The signs may be mounted on different posts or support systems and the students may identify these systems with pertinent State or local specifications. Discuss the different systems with the class.
- While the other groups are preparing their presentations, the third group may be assigned to identify the specification of each specific sign and temporary pavement marking materials in the "Project Inspector's Guide, For the Construction Work Zone" (3M). The group should compare and be prepared to identify specification for Stimsonite, using the 2-1/2-inch by 4-inch catalog and the Nikkalite Retroreflective Products handbook. Present to the class and have other two groups write in the specification in their handouts.
- Summarize and conclude the workshop.

Other workshops can be developed for this hour; however, it is essential that the following workshop objectives be accomplished:

- The students identify and learn the specifications to accept new signing materials from the
 three leading manufacturers (3M, Nippon Caribide Industries, and Stimsonite). State and/
 or local specifications must be identified and referenced by the students. The AASHTO
 and/or ASTM should also he referenced. In most specifications the State and/or locals
 reference AASHTO or ASTM.
 - o Specifications provided in the packet.
 - o Identify manufacturer of signing materials used to fabricate the miniature signs.
 - o Each student must reference the State and/or local specification in their Project Inspector's Guides.
- 2. Identify deficient materials. The students learn the use of comparison blocks of "Engineering Grade," Nippon Caribide Industries. This is an objective if State and/or locals allow the materials to be used in their projects. Show the five slides (numbers 93- 97) to the class. They depict acceptable, marginal, and unacceptable materials. Also, use the slides in conjunction with the Quality Standards for Work Zone Traffic Control Devices. The slides may be copied and used as comparison blocks at project level.
- 3. Identify discrepancies, i.e., improper use of devices, not in accordance with the MUTCD Part VI on miniature cones and typical maintenance layouts for two-lane roadways using

the LDOTD "Maintenance Manual Traffic Control Handbook" with (a) poor alignment, (b) insufficient number of cones, and (c) incorrect cone spacing.

4. Identify temporary pavement markings and specifications using Linear Dynamics, Incorporated's data card.

References:

Packet: 10 each miniature signs and cones.

"Project Inspector's Guide" (One per student).

Nikkalite Retroreflective Products, Nippon Caribide Industries.

Stimsonite sign sheeting samples.

Five slides (nos. 93-97).

ASTM Specifications, Designation D4956-95.

LDI, data card, LDI Series A-4320, A-4320-I, and T-2512. LDOTD, "Maintenance Traffic Control Handbook" (sufficient

copies).

State and Local: Specifications

MUTCD and/or MUTCD Part VI.

Sign post and support(s), pvc or wood construction,

scaled w/base and, additional miniature signs (optional, your source).

Temporary pavement markings materials (optional, your source).

Supplement to the Work Zone Safety Inspection Training Course

SECTION III: Workshops

Introduction:

The two suggested workshops outlined in this section may be supplemented or changed to reinforce and enhance training quality. The workshops are designed for trainer flexibility and to specifically allow the introduction of new and innovative technology.

Workshop 2, with its limited outline, is intended to give the trainer optimum flexibility, but the objectives of the workshop are clearly defined. Additional planning will be necessary to customize the workshops for specific training groups. State and local highway agencies and LTAP administrators are good sources of additional workshop material.

Section I provided the instruction and student handouts for Workshop 1. Section II provided the presentation guidelines. The following provides a more detailed outline for preparing the workshops.

Workshop No. 1

Preparation:

At least three weeks of preparation time is required. The trainer should plan extra time if he or she is unfamiliar with the sponsoring State or local organization and supporting facilities.

To begin:

Refer to sheets IG-1 through IG-3 of the Instructor's Guide: A reply and acknowledgment should have been received from the sponsoring State and/or local agency.

- o Contact the agency and confirm the date, facility, and contacts for training coordination.
- o Request contacts of construction program supervisors (i.e., Construction Engineer, State Engineer's Office, or District Engineers) and obtain permission to video tape a local active area work zone.
- O Contact the Project Engineer and determine if the work zone is adequate for training purposes. If so, make an appointment to video tape the work zone. A 20-minute section is considered adequate. The project engineer should plan for at least four hours to meet and secure a set of plans.

discuss the plan changes (about TCP only), and arrange to get sufficient copies of the TCP and other project documents. About one hour is needed to video tape the project (at the project site).

- Read p;ige IG-54. The video tape (mock-up) will simulate the first three steps of "The steps of the inspection program as discussed in this course..."

 The class, as groups, will complete steps four through six of the six-step inspection procedure.
- Use IG-276, 277, and 278 (Instructor's Guide), and view the workshop's overhead transparencies before and after veiwing the video to select the problems that best fit the work zone (this will correspond with steps four and five of the six-step inspection procedure).
- 0 Review the Student Handout (H14-1), page IG-279, Instructor's Guide. Determine if the instructions are adequate for the workshop.
- O Prepare a summary for the class, consult IG-323.

Workshop No. 2

Preparation:

At least four weeks of preparation time is required. The trainer should plan extra time if he or she is unfamiliar with the sponsoring State or local organization and supporting facilities.

To begin:

Refer to sheets IG-1 through IG-3 of the Instructor's Guide. Use this opportunity as a follow-up to the initial request letter. (Two weeks after the sponsoring State and/or local agency's receipt of the initial request letter is normally sufficient time for the agency to prepare the class.) Request assistance for training aids from maintenance and/or sign shops:

Purpose: To accomplish Workshop No. 2 objectives (copied below from Section II).

- Identify and learn the specifications (State and/or local) to accept new signing materia]s from
 the three leading manufacturers (3M, Nippon Caribide Industries, and Stimsonite). Compare
 to AASHTO and/or ASTM Specifications, if different (in most specifications the State and/or
 local agencies reference AASHTO and ASTM).
- Learn to identify deficient materials.
- 3. Learn to identify discrepancies, i.e., improper use of devices, not in accordance with the

MUTCD Part VI and/or State or local manuals.

4. Learn to identify temporary pavement markings and specifications.

SUGGESTIONS:

- SET UP MINIATURE SIGNS ON PROPORTIONAL POSTS.
 - o Pipe and/or wood construction (approximately 6:1 ratio).
 - o Demonstrate connections (show actual size, i.e., holes spacing from simulated ground level).
 - o Fabricate bases for the signs.
 - o Fabricate frame sign supports (similar to acceptable State/local sign frames and approximately in proportion to the 6:1 ratio of miniature signs).

FABRICATE ADDITIONAL MINIATURE SIGNS.

- o Determine which layout will best demonstrate lane closure of two-lane roadway using a flagger from the Louisiana Department of Transportation and Development "Maintenance Traffic Control Handbook" (or State or local reference).
- o Request fabrication of additional miniature signs (and/or flags needed to complete the layout.
- o Drill miniature signs for screws (plastic screws preferable).
- o Request fabrication of protective case for additional signs, sign posts, and frames for storage and handling.

PURCHASE ADDITIONAL MINIATURE CONES.

o Determine additional number required for corresponding layout (above).

- SUGGESTED STUDENT HANDOUT (Group 1).

- o Copy the assigned layout as a problem.
- o After assigning the three groups (see Section II, Presenting Workshop No. 2) for the one-hour workshop, the suggested written instructions may be handed out to one of the groups. The other two groups should be given verbal instructions.

INSTRUCTIONS

Workshop No. 2

You are a maintenance supervisor with the Maintenance Department or Office. You have received a shop order to repair the pavement at S.R. 50. This is in proximity to but outside the work zone shown in the TCP. The maintenance engineer has determined that it is in the public interest to have the work performed by your crews and not by contract change order:

(30 Minutes)

- 1. Given the layout:
 - A. Select the signs and other traffic control devices needed to properly lay out the work area.
 - B. Lay out the area (at site designated by the trainer).
 - C. Discuss procedures for the layout with the class.

(30 Minutes)

2. Rotate to other Groups as a class.

Supplement to the Work Zone Safety Inspection Training Course APPENDIX I: Training Materials

	Work Zone Safety Instructor Training Course Case Contents
Qty.	Description
1	3M Project Inspector's Guide for the Construction Work Zone (Pub.# 75-0300-2887-4 1996)
1	AASHTO: A Guide to NTPEP: AASHTO's National Transportation Product Evaluation Program
1	AASHTO Publications booklet
1	ATSSA Education and Training Catalog (Fall 1995)
1	ATSSA Flagging Handbook (15th Edition-15M Feb. 1996)
1	ATSSA Products and Services Catalog (March 1995)
1	ATSSA Quality Standards for Work Zone Traffic Control Devices (1993)
1	Envelope containing 4-comparison slides of engineering grade sheeting
1	Box containing 92-35mm slides
1	Flagging Tips Brochure (Kentucky Department of Highways/Kentucky Transportation Center)
1	Flint Trading, Inc. brochure on Premark Heavy Duty Adhesive Line
1	Flint Trading, Inc. brochure on RIPACK 2000EX Propane Gas Fired Industrial Heat Torcl with Patented Cold Burning Nozzle
2	Flint Trading, Inc. information sheet on LTL2000 Retrometer
1	Flint Trading, Inc. Price List for Premark 20/20 Flex Preformed Thermoplastic Pavement Marking
2	Flint Trading, Inc. sample of Premark preformed thermoplastic pavement marking
1	IMSA Products and Services Catalog (1995)
1	IMSA Work Zone Traffic Control and Safety Certification Program (Pub.# 95-915)
1	ITRE Technology Transfer Program Flagger's Handbook (March 1995)
1	Large 3-ring binder containing the transparencies and hard-copies for the Work Zone Safety Inspection Training Course and 5 pages listing flagger certification programs/requirements
1	Linear Dynamics, Inc. sample sheet: LDI Series A-4320 Durable Tape
1	Linear Dynamics, Inc. sample sheet: LDI Series A-4320-I Durable Tape
1	Linear Dynamics, Inc. sample sheet: LDI Series T-2512 Removable Tape
1	Nikkalite Retroreflective Products sample folder
1	Packet of Stimsonite high performance grade reflective sheeting samples
10	Protection Services, Inc. mini traffic cones
1	Protection Services, Inc info sheet on BigFoot Self-Ballasting Vertical Channelizer (11/9
1	SHRP Implementation: Innovative Devices for Safer Work Zones (DOT/FHWA/SHRP Pub.# FHWA-SA-95-029 Jan 95)
1	Stebco Products Corp. order envelope for I.D. tag
1	Stebco Products Corp. order envelope for personalized name plate; contains 4 35mm slides
1	Standard Specifications for Retroreflective Sheeting for Traffic Control, ASTM D 4956-95
	Texas Engineering Extension Service, Transportation Training Course Catalog
1	Work Zone Safety Inspection Instructor's Guide (National Highway Institute Course 3806: Pub.# FHWA-HI-96-026 March 1996)

	Work Zone Safety Instructor Training Course
	Box Contents
Qty.	Description
20	3M Project Inspector's Guide for the Construction Work Zone (Pub.# 75-0300-2887-4 1996)
30	ATSSA Education and Training Catalog (Fall 1995)
25	ATSSA Flagging Handbook (15th Edition-15M Feb. 1996)
15	ATSSA Products and Services Catalog (March 1995)
20	ATSSA Quality Standards for Work Zone traffic Control Devices (1993)
1	Box of 85 Slides for National Safety Council Flagger Training Program Course
10	Work Zone Safety Inspection Participant Notebook copy (National Highway Institute Course 38063, Pub.# FHWA-HI-96-001 Nov. 95)
25	IMSA Products and Services Catalog (1995)
25	IMSA Work Zone Traffic Control and Safety Certification Program (Pub.# 95-915)
1	Maintenance Traffic Control Handbook (Louisiana Transportation Research Center/Louisiana Department of Transportation and Development ETRN# M 4002 B)
1	NSC 3-Ring Binder Containing National Safety Council Flagger Training Program Course Instructor's Guide (Pub. 12783-0000)
1	NSC Envelope Containing Cover Letter from Harold Thompson and the Flagger Training Rules and Procedures Manual (Pub. 12809-0000)
1	NSC National Safety Council Flagger Training Program Course Laminated Pocket Guide (Pub. 12782-0000)
1	NSC National Safety Council Flagger Training Program Course Participant Manual (Pub. 12784-0000)
30	SHRP Implementation: Innovative Devices for Safer Work Zones (DOT/FHWA/SHRP Pub.# FHWA-SA-95-029 Jan 95)
1	Videocassette: Energy Absorbtion Systems, Inc.: Introduction to Work Zone Safety; Introduction to TMA's (13:50)
1	Videocassette: GME: C-29 Arrow Panels (10:00)
1	Videocassette: GME: Flagging Procedures and Devices (8:30)
1	Videocassette: IRF Jobsite Safety Series: Installation, Inspection and Maintenance of Work Site Control Devices (14:00)
1	Videocassette: Nighttime Traffic Control ATSSA/FHWA (8:00)
1	Videocassette: SYRO Steel Co.: ADIEM (5:00)

Supplement to the Work Zone Safety Inspection Training Course

Appendix 2: Substitute Sheets

The following pages are to serve as replacement pages to the Instructor's Guide, as indicated in Section I, page 3 of this supplement. The page substitutions are for presentation of the two-day course.

WORK ZONE SAFETY INSPECTION TRAINING COURSE FHWA CONTRACT NUMBER DTFH61-92-C-00052

Instructor's Guide

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{INSTRUCTOR AGENCY} {LETTERHEAD}

{Date}

Mr./Ms. {Highway Engineer} {Agency Address}

Subject: Work Zone Safety Inspection Training Course

Dear Mr./Ms. {Engineer}:

Thank you for requesting the Work Zone Safety Inspection Training Course. This two-day training course covers critical elements of work zone safety devices and hardware from the viewpoint of inspection. Major components of safety hardware utilized in highway work zones are discussed and the principal areas of each device requiring inspection are treated. The National and State Manuals on Uniform Traffic Control Devices for Streets and Highways (MUTCD) are used to present device standards. Plans, specifications, contract documents, and inspection guidelines from the {agency name} will be used as examples of the contract documents that address the layout, operation, maintenance, and repair of the devices. Checklists for inspection of various work zone devices are included in the course notebook for each participants use. The students are required to bring to class copies of {agency} standard specifications and Part VI of the {agency} or National MUTCD.

Upon completion of the course, highway agency inspectors, project engineers, and technicians should be able to:

- Understand the important features and functional requirements of typical traffic control devices and safety appurtenances used in work zones.
- 2. <u>Identify</u> appropriate documentation, such as the contract, traffic control plan (TCP), specifications, special provisions, standard drawings, and change orders that address the layouts, operation, maintenance, and repair of the devices.
- 3. <u>Inspect</u> common traffic control devices and safety features and identify discrepancies (disagreements and differences) and deficiencies (not up to normal standards).
- 4. <u>Establish</u> records related to inspections and actions taken. Resolve and correct discrepancies. Make recommendations and report deficiencies.

Replaces IG-4

The work zone safety inspection course is comprised of both core and optional modules. Optional modules are selected by you to address areas of interest to your agency. The typical two-day schedule is enclosed.

In order to incorporate your specifications into the course, we will need to obtain some information and an example traffic control plan. We would like to contact your project engineer directly, to request copies of a TCP, special provisions, and other contract documents. Additionally, our instructors would like to videotape a drive through inspection of a work zone with your project engineer.

I have enclosed a summary form for your agency's use to select training modules that you would like us to present. Up to 4-hours of additional modules can be presented in the two-day course. Please indicate the modules you would like presented and return the form at your earliest convenience.

The course is designed for the highway work zone safety inspector/technician level and assumes the inspector has some field experience. A few work zone traffic control plan designers and resident/project engineers will provide a variety of viewpoints to help inspire discussion. Please ask each participant to bring a copy of the {agency} specifications and Part IV of the MUTCD. We limit the class size to 40 and have included specifications for a classroom for 40 participants.

Please send me the name of your training coordinator and day phone number(s). Mr./Ms. {your agency} and Mr./Ms. have been designated as the trainers for this course. Please contact them at {telephone number(s)}.

If you have any questions, please call.

Sincerely,

{LTAP Administrator}

Enclosures

Work Zone Safety Inspection Training Course Two-Day Schedule

Module	<u>Time</u>
Welcome and Introductions	8:00-8:20 a.m.
Description of the Course Objectives of the Course Scope of the Course	8:20-8:40
Attributes of a Good Inspector Professional Ethics	8:40-9:05
Inspection Basics Contract Documents	9:05-9:45
Break	9:45-10:00
Inspection Basics (continued) Inspection Procedures	10:00-10:30
1st Inspection Workshop	10:30-Noon
Lunch Break	12:00-1:00 p.m.
1st Inspection Workshop (continued)	1:00-2:00
Break	2:00-2:15
Nighttime Traffic Control	2:15-2:30
Optional Modules Selected by Agency	2:30-3:00
Break	3:00-3:15
Optional Modules Selected by Agency	3:15-4:00
Dismissal	4:00

Replace IG-14

Work Zone Safety Inspection Training Course Two-Day Schedule

Begin Second Day Instruction	8:00 a.m.
Optional Modules (to be selected by Agency)	8:00-10:00
Break	10:00-10:15
Retroreflective Sheeting	10:15-10:30
Flagging Inspection	10:30-10:45
Portable Changeable Message Signs	10:45-11:00
Break	11:00-11:15
Arrow Panels	11:15-11:30
Markings	11:30-Noon
Lunch Break	12:00-1:00 p.m.
Overview of Agency's Qualified Products Lists and/or AASHTO National Transportation Product Evaluation Program	1:00-1:20
Discussion of Display Materials/Products	1:20-1:30
2 nd Ispection Workshop	1:30-2:30
Guest Speaker and/or Other Training Available	2:30-3:30
Summary	3:30-3:45
Course Evaluations/Course Certificates	3:45-4:00
End Course Instruction	4:00

Standards of
Ethical Conduct
for Employees
of the
Executive Branch



Ethics

Construction Work Zone Inspectors are the backbone of any construction program. Highway, road, and street construction programs are no exception, especially in the construction of those public facilities. Marvelous and ingenious plans and specifications that designers and program administrators devise are but the beginning of a wonderful process. The development of a dream, a concept, is in those plans and specifications and is proposed for bids for contractors to furiously compete to win contracts for the privilege to construct that concept and deliver a product that the public wants and demands.

It would be a perfect process if those contractors who win and legally execute those contracts would just mail in their progress payment requests in the required forms, in triplicate, to the contract administrator (Contract Officer) and receive payment and reimbursement for their work. But try as we do, a perfect process has not been developed. So inspectors are entrusted by the contract officer to give a detailed, honest, and factual account of the contractors' operations and work.

The process that I briefly described produces public highways, roads, and streets that are second to none. The institutionalized process that we are all familiar with, and participate in, is credited with tremendous successes. The completion of the Interstate System is the most notable example that everyone recognizes. At its peak, the construction of the Interstate Highway System was the biggest peacetime undertaking in modern history. We inspectors and engineers should be proud to be a part of this great industry.

But the wonder of it all is that, through the many new developments in technology, methods, practices, procedures, and their applications to construction and operations, professional ethics has developed as a strong and steadfast value in every aspect of the construction program. Professional ethics is a subject of study of its own and beyond the scope of this Construction Safety Work Zone Inspector's Course; however, it is important enough and is included here to remind all of us of the public trust inherent in all Government contracts. Many of the contract documents, which will be discussed later this morning, make no direct reference to ethics, but as Government Employees, we are bound to "Standards of Ethical Conduct for Employees of the Executive Branch" (Codified in 5 C.F.R. Part 2635). Parts 2635.01, Basic obligation of public service; 2635, Definitions; and 2635.103 through 2635.203, were copied for your ready reference from the Final Regulation Issued by the U.S. Office of Government Ethics.

Ethics is an industry standard. How many of you are professional engineers? In your offices how many of your project engineers are professional engineers? Copies of the Principles and Canons of Ethics, American Society of Civil Engineers, are also included as a good example.

Of particular interest is Subpart B-Gifts from Outside Sources, 2635-20 Overview, page 8 in your handout. Take a few seconds to read it along with me. My advice is the same advice I was given by a project engineer in Texas: Don't accept anything from anybody of any value except advice, and that you can take or leave.

PART 2635--STANDARDS OF ETHICAL CONDUCT FOR EMPLOYEES OF THE EXECUTIVE BRANCH

Authority: 5 U.S.C. 7351, 7353; 5 U.S.C. App. (Ethics in Government Act of 1978); E.O. 12674, 54 FR 15159, 3 CFR, 1989 Comp., p. 215, as modified by E.O. 12731, 55 FR 42547, 3 CFR, 1990 Comp., p. 306.

Source: 57 FR 35042, Aug. 7, 1992, unless otherwise noted.

Subpart A--General Provisions

§ 2635.101 Basic obligation of public service.

- (a) Public service is a public trust. Each employee has a responsibility to the United States Government and its citizens to place loyalty to the Constitution, laws and ethical principles above private gain. To ensure that every citizen can have complete confidence in the integrity of the Federal Government, each employee shall respect and adhere to the principles of ethical conduct set forth in this section, as well as the implementing standards contained in this part and in supplemental agency regulations.
- (b) General principles. The following general principles apply to every employee and may form the basis for the standards contained in this part. Where a situation is not covered by the standards set forth in this part, employees shall apply the principles set forth in this section in determining whether their conduct is proper.
- (1) Public service is a public trust, requiring employees to place loyalty to the Constitution, the laws and ethical principles above private gain.
- (2) Employees shall not hold financial interests that conflict with the conscientious performance of duty.
- (3) Employees shall not engage in financial transactions using nonpublic Government information or allow the improper use of such information to further any private interest.
- (4) An employee shall not, except as permitted by subpart B of this part, solicit or accept any gift or other item of monetary value from any person or entity seeking official action from, doing business with, or conducting activities regulated by the employee's agency, or whose interests may be substantially affected by the performance or nonperformance of the employee's duties.
 - (5) Employees shall put forth honest effort in the performance of their duties.

- (6) Employees shall not knowingly make unauthorized commitments or promises of any kind purporting to bind the Government.
 - (7) Employees shall not use public office for private gain.
- (8) Employees shall act impartially and not give preferential treatment to any private organization or individual.
- (9) Employees shall protect and conserve Federal property and shall not use it for other than authorized activities.
- (10) Employees shall not engage in outside employment or activities, including seeking or negotiating for employment, that conflict with official Government duties and responsibilities.
- (11) Employees shall disclose waste, fraud, abuse, and corruption to appropriate authorities.
- (12) Employees shall satisfy in good faith their obligations as citizens, including all just financial obligations, especially those--such as Federal, State, or local taxes--that are imposed by law.
- (13) Employees shall adhere to all laws and regulations that provide equal opportunity for all Americans regardless of race, color, religion, sex, national origin, age, or handicap.
- (14) Employees shall endeavor to avoid any actions creating the appearance that they are violating the law or the ethical standards set forth in this part. Whether particular circumstances create an appearance that the law or these standards have been violated shall be determined from the perspective of a reasonable person with knowledge of the relevant facts.
- (c) Related statutes. In addition to the standards of ethical conduct set forth in this part, there are conflict of interest statutes that prohibit certain conduct. Criminal conflict of interest statutes of general applicability to all employees, 18 U.S.C. 201, 203, 205, 208, and 209, are summarized in the appropriate subparts of this part and must be taken into consideration in determining whether conduct is proper. Citations to other generally applicable statutes relating to employee conduct are set forth in subpart I and employees are further cautioned that there may be additional statutory and regulatory restrictions applicable to them generally or as employees of their specific agencies. Because an employee is considered to be on notice of the requirements of any statute, an employee should not rely upon any description or synopsis of a statutory restriction, but should refer to the statute itself and obtain the advice of an agency ethics official as needed.

The definitions listed below are used throughout this part. Additional definitions appear in the subparts or sections of subparts to which they apply. For purposes of this part:

- (a) Agency means an executive agency as defined in 5 U.S.C. 105 and the Postal Service and the Postal Rate Commission. It does not include the General Accounting Office or the Government of the District of Columbia.
- (b) Agency designee refers to any employee who, by agency regulation, instruction, or other issuance, has been delegated authority to make any determination, give any approval, or take any other action required or permitted by this part with respect to another employee. An agency may delegate these authorities to any number of agency designees necessary to ensure that determinations are made, approvals are given, and other actions are taken in a timely and responsible manner. Any provision that requires a determination, approval, or other action by the agency designee shall, where the conduct in issue is that of the agency head, be deemed to require that such determination, approval or action be made or taken by the agency head in consultation with the designated agency ethics official.
- (c) Agency ethics official refers to the designated agency ethics official or to the alternate designated agency ethics official, referred to in §2638.202(b) of this chapter, and to any deputy ethics official, described in §2638.204 of this chapter, who has been delegated authority to assist in carrying out the responsibilities of the designated agency ethics official.
- (d) Agency programs or operations refers to any program or function carried out or performed by an agency, whether pursuant to statute, Executive order, or regulation.
- (e) Corrective action includes any action necessary to remedy a past violation or prevent a continuing violation of this part, including but not limited to restitution, change of assignment, disqualification, divestiture, termination of an activity, waiver, the creation of a qualified diversified or blind trust, or counseling.
- (f) Designated agency ethics official refers to the official designated under §2638.201 of this chapter.
- (g) Disciplinary action includes those disciplinary actions referred to in Office of Personnel Management regulations and instructions implementing provisions of title 5 of the United States Code or provided for in comparable provisions applicable to employees not subject to title 5, including but not limited to reprimand, suspension, demotion, and removal. In the case of a military officer, comparable provisions may include those in the Uniform Code of Military Justice.
- (h) Employee means any officer or employee of an agency, including a special Government employee. It includes officers but not enlisted members of the uniformed services. For purposes other than subparts B and C of this part, it does not include the President or Vice

President. Status as an employee is unaffected by pay or leave status or, in the case of a special Government employee, by the fact that the individual does not perform official duties on a given day.

- (I) Head of an agency means, in the case of an agency headed by more than one person, the chair or comparable member of such agency.
 - (j) He, his, and him include she, hers and her.
- (k) Person means an individual, corporation and subsidiaries it controls, company, association, firm, partnership, society, joint stock company, or any other organization or institution, including any officer, employee, or agent of such person or entity. For purposes of this part, a corporation will be deemed to control a subsidiary if it owns 50 percent or more of the subsidiary's voting securities. The term is all-inclusive and applies to commercial ventures and nonprofit organizations as well as to foreign, State, and local governments, including the Government of the District of Columbia. It does not include any agency or other entity of the Federal Government or any officer or employee thereof when acting in his official capacity on behalf of that agency or entity.
- (1) Special Government employee means those executive branch officers or employees specified in 18 U.S.C. 202(a). A special Government employee is retained, designated, appointed, or employed to perform temporary duties either on a full-time or intermittent basis, with or without compensation, for a period not to exceed 130 days during any consecutive 365-day period.
 - (m) Supplemental agency regulation means a regulation issued pursuant to §2635.105.

§ 2635.103 Applicability to members of the uniformed services.

The provisions of this part, except this section, are not applicable to enlisted members of the uniformed services. Each agency with jurisdiction over enlisted members of the uniformed services shall issue regulations defining the ethical conduct obligations of enlisted members under its jurisdiction. Those regulations shall be consistent with Executive Order 12674, April 12, 1989, as modified, and may prescribe the full range of statutory and regulatory sanctions, including those available under the Uniform Code of Military Justice, for failure to comply with such regulations.

§ 2635.104 Applicability to employees on detail.

(a) Details to other agencies. Except as provided in paragraph (d) of this section, an employee on detail, including a uniformed officer on assignment, from his employing agency to another agency for a period in excess of 30 calendar days shall be subject to any supplemental agency regulations of the agency to which he is detailed rather than to any supplemental agency

regulations of his employing agency.

- (b) Details to the legislative or judicial branch. An employee on detail, including a uniformed officer on assignment, from his employing agency to the legislative or judicial branch for a period in excess of 30 calendar days shall be subject to the ethical standards of the branch or entity to which detailed. For the duration of any such detail or assignment, the employee shall not be subject to the provisions of this part, except this section, or, except as provided in paragraph (d) of this section, to any supplemental agency regulations of his employing agency, but shall remain subject to the conflict of interest prohibitions in title 18 of the United States Code.
- (c) Details to non-Federal entities. Except to the extent exempted in writing pursuant to this paragraph, an employee detailed to a non-Federal entity remains subject to this part and to any supplemental agency regulation of his employing agency. When an employee is detailed pursuant to statutory authority to an international organization or to a State or local government for a period in excess of six months, the designated agency ethics official may grant a written exemption from subpart B of this part based on his determination that the entity has adopted written ethical standards covering solicitation and acceptance of gifts which will apply to the employee during the detail and which will be appropriate given the purpose of the detail.
- (d) Applicability of special agency statutes. Notwithstanding paragraphs (a) and (b) of this section, an employee who is subject to an agency statute which restricts his activities or financial holdings specifically because of his status as an employee of that agency shall continue to be subject to any provisions in the supplemental agency regulations of his employing agency that implement that statute.

§ 2635.105 Supplemental agency regulations.

In addition to the regulations set forth in this part, an employee shall comply with any supplemental agency regulations issued by his employing agency under this section.

- (a) An agency that wishes to supplement this part shall prepare and submit to the Office of Government Ethics, for its concurrence and joint issuance, any agency regulations that supplement the regulations contained in this part. Supplemental agency regulations which the agency determines are necessary and appropriate, in view of its programs and operations, to fulfill the purposes of this part shall be:
 - (1) In the form of a supplement to the regulations in this part; and
 - (2) In addition to the substantive provisions of this part.
- (b) After concurrence and co-signature by the Office of Government Ethics, the agency shall submit its supplemental agency regulations to the Federal Register for publication and

codification at the expense of the agency in title 5 of the Code of Federal Regulations.

Supplemental agency regulations issued under this section are effective only after concurrence and co-signature by the Office of Government Ethics and publication in the Federal Register.

- (c) This section applies to any supplemental agency regulations or amendments thereof issued under this part. It does not apply to:
- (1) A handbook or other issuance intended merely as an explanation of the standards contained in this part or in supplemental agency regulations;
 - (2) An instruction or other issuance the purpose of which is to:
- (I) Delegate to an agency designee authority to make any determination, give any approval or take any other action required or permitted by this part or by supplemental agency regulations; or
- (ii) Establish internal agency procedures for documenting or processing any determination, approval or other action required or permitted by this part or by supplemental agency regulations, or for retaining any such documentation; or
- (3) Regulations or instructions that an agency has authority, independent of this part, to issue, such as regulations implementing an agency's gift acceptance statute, protecting categories of nonpublic information or establishing standards for use of Government vehicles. Where the content of any such regulations or instructions was included in the agency's standards of conduct regulations issued pursuant to Executive Order 11222 and the Office of Government Ethics concurs that they need not be issued as part of an agency's supplemental agency regulations, those regulations or instructions may be promulgated separately from the agency's supplemental agency regulations.

§ 2635.106 Disciplinary and corrective action.

- (a) Except as provided in §2635.107, a violation of this part or of supplemental agency regulations may be cause for appropriate corrective or disciplinary action to be taken under applicable Government-wide regulations or agency procedures. Such action may be in addition to any action or penalty prescribed by law.
- (b) It is the responsibility of the employing agency to initiate appropriate disciplinary or corrective action in individual cases. However, corrective action may be ordered or disciplinary action recommended by the Director of the Office of Government Ethics under the procedures at part 2638 of this chapter.

(c) A violation of this part or of supplemental agency regulations, as such, does not create any right or benefit, substantive or procedural, enforceable at law by any person against the United States, its agencies, its officers or employees, or any other person. Thus, for example, an individual who alleges that an employee has failed to adhere to laws and regulations that provide equal opportunity regardless of race, color, religion, sex, national origin, age, or handicap is required to follow applicable statutory and regulatory procedures, including those of the Equal Employment Opportunity Commission.

§ 2635.107 Ethics advice.

- (a) As required by §§2638.201 and 2638.202(b) of this chapter, each agency has a designated agency ethics official who, on the agency's behalf, is responsible for coordinating and managing the agency's ethics program, as well as an alternate. The designated agency ethics official has authority under §2638.204 of this chapter to delegate certain responsibilities, including that of providing ethics counseling regarding the application of this part, to one or more deputy ethics officials.
- (b) Employees who have questions about the application of this part or any supplemental agency regulations to particular situations should seek advice from an agency ethics official. Disciplinary action for violating this part or any supplemental agency regulations will not be taken against an employee who has engaged in conduct in good faith reliance upon the advice of an agency ethics official, provided that the employee, in seeking such advice, has made full disclosure of all relevant circumstances. Where the employee's conduct violates a criminal statute, reliance on the advice of an agency ethics official cannot ensure that the employee will not be prosecuted under that statute. However, good faith reliance on the advice of an agency ethics official is a factor that may be taken into account by the Department of Justice in the selection of cases for prosecution. Disclosures made by an employee to an agency ethics official are not protected by an attorney-client privilege. An agency ethics official is required by 28 U.S.C. 535 to report any information he receives relating to a violation of the criminal code, title 18 of the United States Code.

Subpart B--Gifts From Outside Sources

§ 2635.201 Overview.

This subpart contains standards that prohibit an employee from soliciting or accepting any gift from a prohibited source or given because of the employee's official position unless the item is excluded from the definition of a gift or falls within one of the exceptions set forth in this subpart.

§ 2635.202 General standards.

- (a) General prohibitions. Except as provided in this subpart, an employee shall not, directly or indirectly, solicit or accept a gift:
 - (1) From a prohibited source; or
 - (2) Given because of the employee's official position.
- (b) Relationship to illegal gratuities statute. Unless accepted in violation of paragraph (c)(1) of this section, a gift accepted under the standards set forth in this subpart shall not constitute an illegal gratuity otherwise prohibited by 18 U.S.C. 201(c)(1)(B).
- (c) Limitations on use of exceptions. Notwithstanding any exception provided in this subpart, other than §2635.204(j), an employee shall not:
 - (1) Accept a gift in return for being influenced in the performance of an official act;
 - (2) Solicit or coerce the offering of a gift;
- (3) Accept gifts from the same or different sources on a basis so frequent that a reasonable person would be led to believe the employee is using his public office for private gain;
- Example 1: A purchasing agent for a Veterans Administration hospital routinely deals with representatives of pharmaceutical manufacturers who provide information about new company products. Because of his crowded calendar, the purchasing agent has offered to meet with manufacturer representatives during his lunch hours Tuesdays through Thursdays and the representatives routinely arrive at the employee's office bringing a sandwich and a soft drink for the employee. Even though the market value of each of the lunches is less than \$6 and the aggregate value from any one manufacturer does not exceed the \$50 aggregate limitation in \$2635.204(a) on de minimis gifts of \$20 or less, the practice of accepting even these modest gifts on a recurring basis is improper.

- (4) Accept a gift in violation of any statute. Relevant statutes applicable to all employees include:
- (I) 18 U.S.C. 201(b), which prohibits a public official from seeking, accepting, or agreeing to receive or accept anything of value in return for being influenced in the performance of an official act or for being induced to take or omit to take any action in violation of his official duty. As used in 18 U.S.C. 201(b), the term "public official" is broadly construed and includes regular and special Government employees as well as all other Government officials;
- (ii) 18 U.S.C. 209, which prohibits an employee, other than a special Government employee, from receiving any salary or any contribution to or supplementation of salary from any source other than the United States as compensation for services as a Government employee. The statute contains several specific exceptions to this general prohibition, including an exception for contributions made from the treasury of a State, county, or municipality; and
- (iii) 41 U.S.C. 423(b)(2), which prohibits a procurement official from seeking, accepting, or agreeing to receive any money, gratuity, or other thing of value from any officer, employee, representative, agent, or consultant of a competing contractor during the conduct of a Federal agency procurement. Implementing regulations, including exceptions to the gift prohibition, are contained in the Federal Acquisition Regulation, 48 CFR 3.104; or
- (5) Accept vendor promotional training contrary to applicable regulations, policies or guidance relating to the procurement of supplies and services for the Government, except pursuant to §2635.204(1). [57 FR 35041, Aug. 7, 1992; 57 FR 48557, Oct. 27, 1992]

§ 2635.203 Definitions.

For purposes of this subpart, the following definitions shall apply:

- (a) Agency has the meaning set forth in §2635.102(a). However, for purposes of this subpart, an executive department, as defined in 5 U.S.C. 101, may, by supplemental agency regulation, designate as a separate agency any component of that department which the department determines exercises distinct and separate functions.
- (b) Gift includes any gratuity, favor, discount, entertainment, hospitality, loan, forbearance, or other item having monetary value. It includes services as well as gifts of training, transportation, local travel, lodgings and meals, whether provided in-kind, by purchase of a ticket, payment in advance, or reimbursement after the expense has been incurred. It does not include:
- (1) Modest items of food and refreshments, such as soft drinks, coffee and donuts, offered other than as part of a meal;

- (2) Greeting cards and items with little intrinsic value, such as plaques, certificates, and trophies, which are intended solely for presentation;
- (3) Loans from banks and other financial institutions on terms generally available to the public;
- (4) Opportunities and benefits, including favorable rates and commercial discounts, available to the public or to a class consisting of all Government employees or all uniformed military personnel, whether or not restricted on the basis of geographic considerations;
- (5) Rewards and prizes given to competitors in contests or events, including random drawings, open to the public unless the employee's entry into the contest or event is required as part of his official duties;
- (6) Pension and other benefits resulting from continued participation in an employee welfare and benefits plan maintained by a former employer;
- (7) Anything which is paid for by the Government or secured by the Government under Government contract:

Note: Some airlines encourage those purchasing tickets to join programs that award free flights and other benefits to frequent fliers. Any such benefit earned on the basis of Government-financed travel belongs to the agency rather than to the employee and may be accepted only insofar as provided under 41 CFR 301-1.6(b).

- (8) Any gift accepted by the Government under specific statutory authority, including:
- (I) Travel, subsistence, and related expenses accepted by an agency under the authority of 31 U.S.C. 1353 in connection with an employee's attendance at a meeting or similar function relating to his official duties which takes place away from his duty station. The agency's acceptance must be in accordance with the implementing regulations at 41 CFR part 304-1; and
- (ii) Other gifts provided in-kind which have been accepted by an agency under its agency gift acceptance statute; or
 - (9) Anything for which market value is paid by the employee.
- (c) Market value means the retail cost the employee would incur to purchase the gift. An employee who cannot ascertain the market value of a gift may estimate its market value by reference to the retail cost of similar items of like quality. The market value of a gift of a ticket entitling the holder to food, refreshments, entertainment, or any other benefit shall be the face value of the ticket.

Example 1: An employee who has been given an acrylic paperweight embedded with the corporate logo of a prohibited source may determine its market value based on her observation that a comparable acrylic paperweight, not embedded with a logo, generally sells for about \$20.

Example 2: A prohibited source has offered an employee a ticket to a charitable event consisting of a cocktail reception to be followed by an evening of chamber music. Even though the food, refreshments, and entertainment provided at the event may be worth only \$20, the market value of the ticket is its \$250 face value.

- (d) Prohibited source means any person who:
- (1) Is seeking official action by the employee's agency;
- (2) Does business or seeks to do business with the employee's agency;
- (3) Conducts activities regulated by the employee's agency;
- (4) Has interests that may be substantially affected by performance or nonperformance of the employee's official duties; or
- (5) Is an organization a majority of whose members are described in paragraphs (d) (1) through (4) of this section.
- (e) A gift is solicited or accepted because of the employee's official position if it is from a person other than an employee and would not have been solicited, offered, or given had the employee not held his position as a Federal employee.

Note: Gifts between employees are subject to the limitations set forth in subpart C of this part.

Example 1: Where free season tickets are offered by an opera guild to all members of the Cabinet, the gift is offered because of their official positions.

- (f) A gift which is solicited or accepted indirectly includes a gift:
- (1) Given with the employee's knowledge and acquiescence to his parent, sibling, spouse, child, or dependent relative because of that person's relationship to the employee, or
- (2) Given to any other person, including any charitable organization, on the basis of designation, recommendation, or other specification by the employee, except as permitted for the disposition of perishable items by §2635.205(a)(2) or for payments made to charitable organizations in lieu of honoraria under §2636.204 of this chapter.
- Example 1: An employee who must decline a gift of a personal computer pursuant to this subpart

may not suggest that the gift be given instead to one of five charitable organizations whose names are provided by the employee.

(g) Vendor promotional training means training provided by any person for the purpose of promoting its products or services. It does not include training provided under a Government contract or by a contractor to facilitate use of products or services it furnishes under a Government contract.

Module II. Inspection Basics

Participant's Notebook Text INTRODUCTION

In this module, we will cover the basics of work zone safety inspections. The topics covered will provide a basis for development of an effective work zone safety inspection program. This module consists of three submodules described below.

Submodule II.A. Traffic Control Plans and Related Documents

In this submodule, we will discuss what documents relate to work zone safety inspections and how they can be used to help in the development and maintenance of a work zone safety inspection program. Also, the importance of the use and completion of documents related to work zone inspection will be discussed as it relates to good practices.

Submodule II.B. Inspection Procedures

The basic procedures of work zone safety inspections will be covered. A six-step process will be outlined that can be used or modified to provide an overall method for work zone inspection and maintenance. The six steps are: Preparation, Yard Inspection, Drive-Through Inspections, Stationary Observation of Traffic Operations, Walk-Up Inspections, and Documentation Procedures.

Submodule II.C. Inspection Workshop

In this module, the class will be split into groups. Each group will be given plans of a work zone and asked to describe a strategy for inspecting that work zone. Later, photographs of the work zone under consideration will be distributed and used to determine discrepancies and deficiencies in the work zone. At the end of this submodule the groups will convene to discuss the results of their work zone inspections.

Note: Pages IG-37 and IG-38 should be adapted to reflect changes made to customize this course.

OV2A-1 - "REVIEW OF CONTRACT DOCUMENTS"

Show the overhead and state the documents you will be showing and describing.

OV2A-2 - "CONTRACT DOCUMENTS GOVERN IN THE FOLLOWING ORDER"

Show the overhead.

These contract documents are complementary. A requirement in one document is binding as though occurring in all the contract documents. Requirements in the Standard Specifications are overruled by the requirements in the Plans. Requirements in the Plans are overruled by the requirements in the Contract and Special Provisions.

OV2A-3 - "LOCATE AND REVIEW THE FOLLOWING PLAN SHEETS"

The first document that we will discuss is the Traffic Control Plan.

Pass out TCP that will be used in Workshop I.

The traffic control plan for one of your projects is being passed out.

We will go through the TCP and identify some of the sheets that pertain to the traffic control items. Find the INDEX OF SHEETS on the title page.

On the following lines, fill in the page numbers from the agency's sample TCP.

The traffic control sheets are on pages	
The construction detail sheets are on pages	. The state of the
The project layout sheets are on pages	aparate de Marillon, de propositiones
Estimate and quantity sheets	
Device standard sheets	
TCP standard sheets or estimate summary sheets	

Show the standard specification book.

The Standard Specification Book has an agency's overall guiding specifications for road construction. The standard specifications are approved for general application and repetitive use. (Discuss all sections where traffic control items are presented.)

Show the Special Provisions.

The Special Provisions are modifications to the standard specifications and are applicable to an individual project. They are also used to amplify and expand the information presented in the specifications. They may also present information on devices that are not in the specifications, for example, impact attenuators or radar speed advisory signs.

Show the standard plans in the TCP.

The standard plans are usually approved for repetitive use and may not be in the plans.

Show the MUTCD and Part VI of the MUTCD.

The MUTCD presents the national standard for traffic control devices. Part VI deals with temporary work zone situations.

Show an example of the Certificate of Compliance.

The Certificate of Compliance is provided by the contractor to prove that products delivered to the project meet your Department's material requirements.

Show an example of a Documentation Record.

The Documentation Record documents what was installed in the field and/or gives authority for those items to be installed. Payments to the contractor are made from this document.

Show an example of an Order Record.

The Order Record orders a contractor to do something and is required to ensure compliance by the contractor

Show an example of a Change Order.

The Change Order is used to get additional work done that may not have been in the original contract.

Now show the students how to track a couple of devices through the various documents. Ideally, you have received the plans in advance and have already found the appropriate sheets.

Module II.C. First Inspection Workshop

INSTRUCTION SUMMARY

Duration:

2 ½ hours

Objective:

To get participants actively thinking about the inspection process, and to

prepare them for doing an "actual" work zone inspection using

photographs in the Inspection Workshop.

Content:

In-class exercise; no written content

Equipment:

None

Aids:

Sufficient number of the "First Inspection Workshop Instructions"

handouts for all classroom students.

Handouts of local jurisdiction's plan sheets Agency's specifications and special provisions

First Inspection Workshop

Using Contract Documents

Situation:

You have been assigned to inspect a project for the first time tomorrow. Traffic controls on this project are installed and the first phase of work has been underway for 3 months.

Instructions:

- 1. Use your notebook, plans, standard specifications, and special provisions.
- 2. List the steps you would take in inspecting this zone and be prepared to discuss them with the class.
- 3. Determine:
 - a. How many Arrow Panels are on the job?
 - b. Is flagging anticipated?
 - c. How many phases?
 - d. What lane closure restrictions are there on the job?
- 4. Where did you find the above information?
- 5. How often are inspections required?
- 6. After viewing the video, what phase and stage of the project appears to correspond with the work?

Module II.C. First Inspection Workshop

Participant's Notebook Text SURVEY AND PREPARATION

Visual Aids H2C-1

You have been assigned to inspect a project on a nearby work zone for the first time tomorrow. Traffic controls on the project have been installed and you will be provided with information on the current phase and duration of work. Traffic control plans for the project will be provided for you to prepare for your inspection procedure. You are to list the steps you would take in inspecting this zone and be prepared to discuss them with the rest of the class.

- 1. View the 20-minute video.
- 2. Review your problem sets.
- 3. Within your group:
 - a. Determine the inspection procedure and inspection checklist.
 - b. Specifications that apply
 - c. Discuss the problem with your group and write inspection report for contractor resolve and report for the project engineer.
- 4. Present report to the class.

Module III.B. Retroreflective Sheeting

Participant's Notebook Text INTRODUCTION

Visual Aids
OV3B-1
Retroreflective
Sheeting

Retroreflective sheeting is a very important part of any work zone that remains in place for even one overnight period. Retroreflective sheeting makes devices that are otherwise invisible to motorists stand out and command attention and respect. There are several types of retroreflective sheeting, which we will examine in this chapter.

Do work zone devices have approved sheeting as specified in the TCP?

OV3B-2 Retroreflective Sheeting Types

All signs used at night shall be either retroreflective or illuminated. In general, construction zone warning signs should all be retroreflective, unless otherwise specified in the TCP. Several manufacturers make a wide variety of retroreflective sheetings. These sheetings vary greatly in pattern, reflectivity, and terminology. However, the Federal Specifications (FP-92) breaks the available sheetings into six distinct types. Note that these six retroreflective sheeting types are also planned for inclusion in the next revision of the MUTCD. The following quote from the FP-92, section 718.02, page 646 defines the six types. The text following the quote will explain the types in more detail, particularly how to identify sheeting of each type:

Retroreflective material is typed as follows:

- (a) Type I. A medium intensity sheeting. An enclosed lens glass-bead material.
- (b) Type II. A medium-high intensity sheeting. An enclosed lens glass-bead material.
- (c) Type III. A high intensity sheeting. An encapsulated glass bead or prismatic material.
- (d) Type IV. A high intensity sheeting. An unmetallized microprismatic element material.
- (e) Type V. A super-high intensity sheeting. A metallized microprismatic element material.
- (f) Type VI. An elastomeric high-intensity sheeting. A vinyl microprismatic material.

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In common parlance, Type I sheeting is more commonly referred to as engineering grade sheeting. Engineering grade sheeting simply consists of an adhesive back surface, with a coating of glass beads on its front surface. There are no identifying marks or symbols on this sheeting. An example of the surface pattern of this type of sheeting is shown in Figure 3B-1. Show four comparison slides and comparison blocks, if used by the agency.

OV3B-3
"Photo of Engineering
Grade Sheeting"



Figure 3B-1. Engineering grade sheeting.

Type II sheeting is often referred to as "super-engineering" grade sheeting. Its surface pattern looks similar to engineering grade sheeting when viewed with the naked eye. Under a microscope, a significantly larger amount of beads per unit surface area can be discerned with this type of sheeting than with engineering grade. This material is made by one specific manufacturer (Nippon Carbide Industries), and can be identified by a star watermark on the face of the sheeting.

Many agencies specify that work zone devices should employ "high-intensity" retroreflective sheeting. This generally refers to Types III-VI. There are several different types of sheetings from separate manufacturers that fit into this category. 3M has a trademarked "High-Intensity" sheeting, which is a Type III sheeting. This sheeting may be distinguished by the distinctive hexagonal pattern on its surface. This surface pattern is illustrated in figure 3B-2.

In addition, a variety of "worker symbols" are apparent on the surface of 3M's Type III High-Intensity sheeting. These symbols vary based on the type of devices which the sheeting is to be used on. The symbols, grouped by device on which they are to be used, are summarized below:

 Drums, other "reboundable" plastic devices - Worker symbol NOT contained within a circle. OV3B-4
"Photo of 3M High-Intensity Sheeting"

- Signs, Barricades, Vertical Panels, Regulatory Signs Worker symbol contained within a 3/8" circle.
- Cones Worker symbol contained within a triangle.

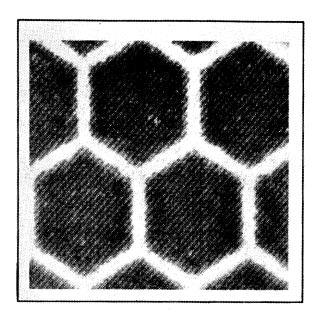


Figure 3B-2. 3M high-intensity sheeting.

Figure 3B-3 shows examples of the worker symbols.

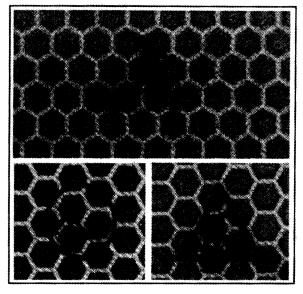


Figure 3B-3. 3M sheeting worker symbols.

Brighter sheetings are also available. These make up the Type IV, V, and VI sheetings. Most of these sheetings are prismatic in nature. These employ an array of tiny cube-corner retroreflectors in a coating on the surface of the sheeting.

An example of Type IV sheeting is Stimsonite's prismatic sheeting. Also, 3M makes a Type VI prismatic sheeting called "Diamond Grade". The different patterns of these sheetings are illustrated in figure 3B-4.

As mentioned before, there are a wide variety of sheeting types available, not all of which are described here. Check the TCP to ensure that the retroreflective sheeting material used on devices you are inspecting in a work zone is approved for use on those devices.

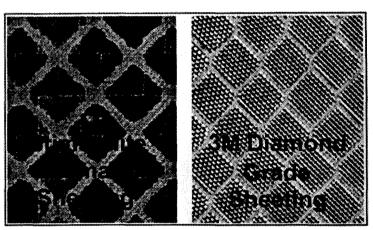


Figure 3B-4. Types of prismatic sheeting.

Are retroreflective sheetings on devices clean and in good condition, with a smooth, sealed surface?

To inspect the general condition of the retroreflective sheeting, see that the sheeting is clean and in good condition, and has a smooth, sealed surface. The surface of the sheeting should be checked for significant residue, peeling, cracking, or other signs of deterioration.

Do all construction zone sign sheetings contain a black legend on an orange background?

Are retroreflective devices clearly legible to approaching drivers?

Construction zone signs should have sheeting with black letters on an orange background and all other sign sheetings should conform to what is shown in the TCP. When driving through the work zone, look at any retroreflective devices; try to understand them and read any signs present. Be sure that all devices are legible from distances that allow motorists passing through the work zone time to take appropriate actions.

OV3B-5
"Photo of Comparison
Between 3M Prismatic
Diamond Grade and
Stimsonite Prismatic
Sheeting"

OV3B-6 Retroreflective Sheeting Condition Are retroreflective sheeting surfaces free from noticeable color fading? Do retroreflective sheeted devices appear to be the same color both during the day and at night?

Color fading is another common problem that must be checked. Often, sign sheeting can appear to be perfectly acceptable during the day, but can undergo a significant color shift under headlight illumination at night.

Note that there are new fluorescent retroreflective sheetings appearing on the market that undergo a color shift under headlight illumination at night, even when in new condition. This phenomenon is a function of the fluorescent properties of the sheeting and does not indicate a defect. However, this sheeting is fairly rare at this time. If this type of sheeting appears on a job you are inspecting, check with the project engineer to determine if this is acceptable. Otherwise, sheetings which undergo significant color shifts at night are unacceptable and should be replaced.

Participant's Notebook Text INTRODUCTION

Flagging operations are most often used in situations where traffic must alternate over one open lane. The most frequent application is probably on two-lane, two-way rural roads where one side of the road must be closed for reconstruction or repair.

While this course is not intended to detail all aspects of flagger conduct and operation, it is important for inspectors to be aware of the major safety issues regarding flagging devices and procedures.

Is the flagger located properly as shown in the TCP?

Is the flagging equipment used of the proper size and color as shown in the TCP?

The TCP should spell out several characteristics of a flagging operation. Check the work zone operation against the TCP to ensure that the flagger is located properly, that the proper flagging equipment is being used, and that any such equipment is of the proper size and color as specified in the TCP.

Do flagging paddles used meet the requirements of the MUTCD?

Generally, hand-signalling devices are used by flaggers to control traffic through temporary traffic control zones. The two most commonly used devices are the Stop/Slow paddle, and a flagger's red flag. The Stop/Slow paddle is the appropriate device to use in most flagger situations. It is the primary hand-signalling device. Flag use should be limited to low-speed and/or low-volume locations which can best be controlled by a single flagger.

Stop/Slow paddles should:

- Be at least 450 x 450 millimeter (18 x 18 inches) with an octagonal shape.
- Be made of a semirigid material such as sheet metal.
- Have reflectorized faces if used at night.
- Have a red background with a white border and STOP in white letters on one side.
- Have an orange background with a black border and SLOW in black letters on the other side.
- Be consistent with the requirements of the MUTCD.

INSPECTION CHECKLIST -- Flagger/Devices

C	ation of Device:	
	Mile Post and Roadway or Job Number	-
۱ny	questions answered NO should be discussed with supervisor.	YES
	Is the flagger located properly as shown in the TCP?	
	Is there a clear escape route for the flagger should there be the need to avoid an errant vehicle?	
.	Is the flagging equipment used of the proper size and color as shown in the TCP?	
	Do flagging paddles used meet the requirements of the MUTCD?	
•	Is the flagger location visible to oncoming traffic at a sufficient distance to allow drivers time to respond to flagger's signal?	
	Flagger equipped with warning device to be used to warn workers of an errant vehicle approaching the work area?	-
•	Are flaggers free of personal radios or other distractions?	
•	Is the flagger standing alone?	-
	Are flaggers certified if required?	•
0.	Are flaggers equipped with any special equipment called for in the contract (cones, flashlights, protective clothing, etc.)?	
1.	Are flaggers using proper flagging etiquette and conducting themselves appropriately to send a clear, respectful message to passing drivers?	
2.	Are flaggers relieved regularly?	
3.	Are flaggers using the proper techniques to signal messages to traffic?	
4.	Are proper advance warning signs in place?	
5.	Are "Flagger Ahead" signs removed when not needed?	
6.	On single-lane, two-way, flagger-controlled work zones, is there a safe means of communication for the flaggers so that traffic control may be properly coordinated?	
7.	Are all flaggers properly attired and equipped with approved vests and hard hats?	
3.	Are all flags, paddles, vests, hard hats, communication and other flagging equipment in good working condition?	
	For questions answered NO, state the question number and problem:	
	State the action resulting from questions answered NO:	

Module XIV. First Inspection Workshop and Summary

INSTRUCTION SUMMARY

Duration:

90 minutes

Part 1, "Field Inspection Workshop Problems" - 45 minutes

Part 2, "Presentation of Results" - 45 minutes

Objective:

To give course participants the opportunity to apply what they have learned about

inspection techniques, and, to the extent possible, to carry the classroom

instruction over to "real-world" application

Content:

Inspection techniques, group field inspection, presentation of results.

Equipment:

Overhead Projector and VCR

Aids:

Handout with instructions to workshop participants show your video of a selected

local work zone project.

Photographs and overheads covering arrow panels, signs, sign mounting, impact attenuators, pavement markings, and barriers. See Supplement to the Instructor's

Guide, Sections II and III.

PRESENTATION OPTIONS

For this workshop, each team should normally consider two photographs. Photographs pertaining to devices covered in modules that were not included in the classroom instruction should not be distributed to the teams as workshop problems. For example, if the arrow panel module was not requested by the sponsoring agency, and no presentation has therefore been made concerning arrow panels, the arrow panel photos should be excluded from this workshop. The visual aids section of this instruction summary, below, is a valuable guide to selecting which problems should be omitted based on the modules presented and your video.

LESSON PLAN

PART 1 - FIELD INSPECTION WORKSHOP PROBLEMS

Workshop problems are presented to teams of inspectors. Photographs of actual work zone devices, safety hardware, and conditions are provided. Questions are asked about the photographs. Participants use their inspector checklists, participant's notebook, Department standards and specifications, and the MUTCD to answer the questions. Thirty-four photographs are used to practice inspection procedures of the following six inspection items: arrow panels, channelizing devices, impact attenuators, pavement markings, portable concrete barrier, and signing. Teams summarize the results of the inspection and develop conclusions of the inspection and recommended actions to correct any problems directly related to the video.

PART 2 - PRESENTATION OF RESULTS

The teams present solutions to the problems. Overhead projections of the photographs are shown while participants discuss and present the solutions. Recommended actions are presented.

SUMMARY

Handout

After the presentations by the team leaders, a summary of the workshop with recommended inspection procedures should be presented.

A few of the more important points of the first workshop should be highlighted:

- MUTCD Part VI contains minimum standards
- Use of checklist
- Importance of inspecting nighttime traffic control for adequate visibility
- Discrepancies versus deficiencies

Contents

VISUAL AIDS

H14-1 Inst	ructions to workshop participants
Photograph	Inspections Items Covered
1	Arrow Panels
1A	Arrow Panels, Channelizing Devices
2	Pavement Markings
2 3 4 5	Pavement Markings
4	Sand Barrel Attenuator
5	Sand Barrel Attenuator
6	GREAT CZ
7	GREAT CZ
8	GREAT CZ
9	Drums and Sheeting
10	Drums
11	Drums
12	Drums
13	Drums
14	Vertical Panels, Drop-offs
15	Drums, Barricades, and Warning Lights
16	Sign Mounting
17	Signs
18	Sign Mounting
19	Signs and Sign Mounting
20	Signs and Sign Mounting
21	Sign Mounting
22	Sign Mounting
23	Drums, Drop-offs
24	Signs, Drums, Drop-offs
25	Barricades, Signs, and Warning Lights
26	Barricades

Replaces IG-278

27	Portable Concrete Barrier
28	Portable Concrete Barrier
28	Portable Concrete Barrier
30	Portable Concrete Barrier
31	Portable Concrete Barrier
32	Portable Concrete Barrier, Object Markers, and Impact Attenuators
33	Portable Concrete Barrier, Object Markers, and Impact Attenuators

SECOND INSPECTION WORKSHOP

Instructions to Workshop Participants

The pictures being distributed show conditions of specific features in the field at your project. Use your notebook, plans, standard specifications, and special provisions to answer the questions on the back of the pictures.

Note: The photos may not be the exact feature viewed on the video of the local work zone project but accept it as that feature with your group in your report to the class.